LEAD

CHADWICK BOSTON LEAD CO.

·BOSTON·MASS·

IN presenting this Catalogue, we have endeavored to impart such information relating to our goods, together with such general information, as will prove acceptable and valuable to our customers.

Should you require anything in the lead line that is not listed in this book, we will, on receipt of your specifications, endeavor to supply the article needed.

We guarantee our goods to be of the best quality in every respect, our prices satisfactory, quality considered, and our promptness in the execution of orders unexcelled.

It has been our constant aim and persistent effort to supply every want that the trade in its progress has demanded, and we trust that our efforts will be rewarded by the liberal and continued patronage of our customers and the trade in general.

Very truly yours,

CHADWICK-BOSTON LEAD CO.

GENERAL LIST OF OUR PRODUCTS

LEAD

PIG, bar, block, pipe, tubing, sleeves, wire, window weights, came, channel, lantern, wedge, wool, traps and bends and all extruded shapes; sheet, ribbon, tape, washers, gaskets, dress weights, shot, net leads, lead-lined tanks and special cast shapes.

Pipe, sheet and fittings of Chemical Lead and "Chadwick Hard Lead" for chemical works, sulphite pulp mills, rayon plants, bleacheries, etc., used in the construction of digesters, saturators, acid tanks and chambers, gas coolers, Gay Lussac towers, chlorination tubs, etc.

Round or drum traps, "Clean Sweep" and Safe Seal Traps, "Raymond" combination lead and iron Ferrules, Athol Ferrules.

RED LEAD AND LITHARGE

For pottery, rubber, glass and pulp making. Special Oxides for battery manufacturers and varnish makers.

WHITE LEAD

"Boston Star" and "Forest River." Dry and in oil.

TIN

Pig, bar, block, pipe, tubing, sheet, ribbon, tape.

SOLDER

Wire and tape solder, "B. L. M. Co." wiping solder, "Chadwick-Boston Lead Co." Extra Fine stick solder, Radio solder, rosin and acid core solder and solder to meet special requirements.

BABBITT METAL

"Government," "Extra Fine," "Reliable," "Medium," and special formulas.

MISCELLANEOUS

Fuse Wire, Composition Organ Tubing, Well Points, Hydraulic Rams, Barnes, Wilder and Athol Pumps and Repairs.


BOSTON LEAD MANUFACTURING COMPANY
PURE WHITE LEAD
THIS LEAD IS WARRANTED
TRADE MARK
STRICTLY PURE
BOSTON LEAD MANUFACTURING CO.
1879
AND FOR
FINENESS, BODY AND DURABILITY.
REGISTERED
CANNOT BE SURPASSED
BOSTON

PURE WHITE LEAD

DRY OR GROUND IN PURE LINSEED OIL

THE "Old Dutch Process" of slow corrosion, as a method of making white lead, has withstood the test of centuries.

Innumerable processes have been invented in an effort to secure a quicker and cheaper method of manufacturing white lead, but none of them can produce a white lead equal in covering power and durability to that made by the "Old Dutch Process."

Our "Boston Star" and "Forest River" brands of white lead are made by this "Old Dutch Process", and no other brand excels them for purity, fineness, body and durability.

"Boston Star" Pure White Lead has been on the market since the incorporation of the Boston Lead Company in 1829, and there is no brand of Pure White Lead better or more favorably known in New England. It is used for the very finest class of work, where SATISFACTION and not price, is the determining factor.

We produce a "Special Interior" white lead which is very desirable for general inside work and particularly adapted to interior decorators' purposes.

Our White Lead is also put up in **soft paste** form, for greater convenience in mixing.

All of our white lead is sold in actual **net weight packages.**


FOREST RIVER
1840
TRADE MARK
FOREST RIVER
LEAD COMPANY.
SALEM.
MASS.
PURE
WHITE LEAD

PURE WHITE LEAD

DRY OR GROUND IN PURE LINSEED OIL

THE "Forest River" brand takes its name from the original site of the mill where this lead was first manufactured in the year 1840 in Salem, Mass.

Perhaps the best possible recommendation for "Forest River" Lead is the fact that some of the original purchasers of this brand, when it was first introduced into the New England market, are on our books as customers today, either in their own names, or in those of their successors.

No white lead manufactured surpasses this brand in the essential characteristics that go to make up a first-class product.

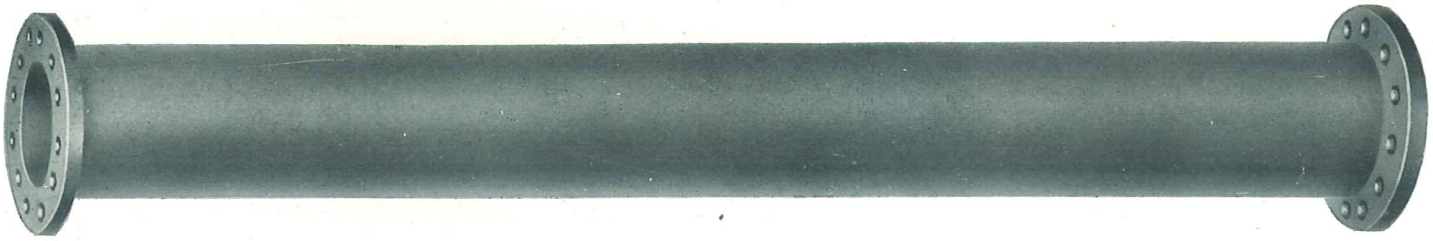
In a recent government test for percentages of carbonate and hydrate to produce the best possible paint pigment, "Forest River" lead showed results nearest to the ideal.

Our offer, originally made over thirty-five years ago, to pay **One Thousand Dollars for every package** of our lead proved to be adulterated by us, still holds good.

FLANGED LEAD PIPE AND FITTINGS

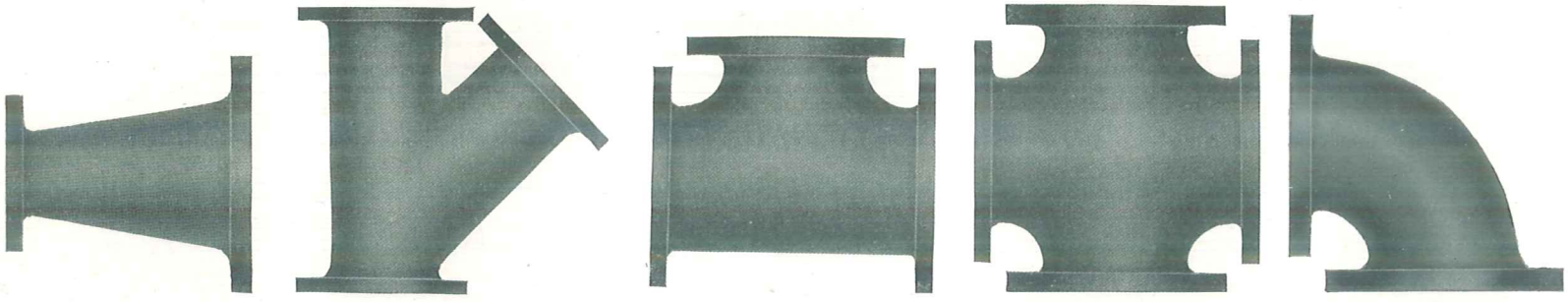
MADE FROM

SOFT CHEMICAL LEAD OR CHADWICK HARD LEAD



A

Lead Pipe with flanges attached, made from soft Chemical Pig Lead, or Chadwick Hard Lead



C Reducer

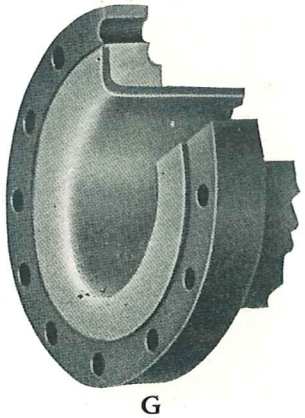
D Y branch or lateral

B Tee

E Cross

F 90° Elbow

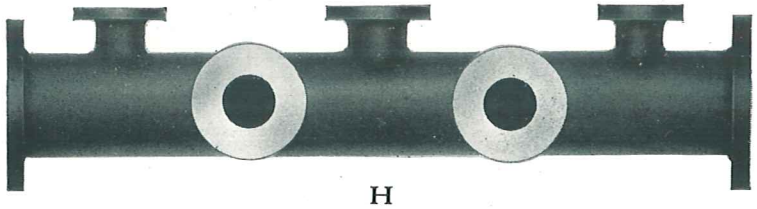
Fittings of same dimensions as standard flanged iron fittings, or furnished to sketch



G

Flanged soft Chemical Lead Pipe with iron reinforcing collars

Any size and length required



H

Distributors made to sketch

CHADWICK HARD LEAD

PIPE, FITTINGS AND SHEETS

WE have been manufacturing this material for thirty-five years and the increasing number of repeat orders is proof of its excellent properties.

It surpasses Chemical Lead in ability to withstand the action of Ammonia Gas, Phosphoric Acid, Sulphuric Acid, or Electrolytic Solutions.

When used with hot liquors or under steam pressure it retains its shape where Chemical Lead would buckle and creep.

It has greater rigidity, acid resistance, tensile strength and elastic limit, also a lower specific gravity, than Chemical Lead.

We are always glad to submit estimates on blue prints or specifications for X-Ray Rooms, Rayon Plants, Bleacheries, Chemical Plants, Pulp and Paper Mills and any other installation where acid resistant material is required.

LEAD PIPE.

LIST OF SIZES AND WEIGHTS.

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
$\frac{1}{8}$ inch	2½	¼
¼ "	5	⅜
	8	7/16
	11	31/64
⅜ inch	6	31/64
	8	34/64
	10	9/16
	12	7/12
	14	39/64
1		41/64
1	4	35/50
1	8	¾
1	12	25/32
2		41/48
½ inch	8	39/64
	10	31/48
	12	43/64
	14	7/10
1		34/48
1	4	49/64
1	8	13/16
1	12	41/48
2		⅞
2	8	46/48
3		1 1/48
4		1⅛
⅝ inch	13	¾
	14	25/32
1		13/16
1	4	27/32
1	8	57/64
1	12	59/64
2		48/50
2	4	1
2	8	1 1/24
2	12	1 1/20
3		1 5/64
3	4	1⅛
3	8	1 3/20
4		1⅕
4	8	1 17/64
¾ inch	12	⅞
	14	57/64
1		58/64
1	2	59/64
1	4	48/50
1	8	63/64
1	12	1 1/64
2		1 1/16
2	4	1 5/64
2	8	1⅛
2	12	1 3/20

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
¾ inch	3	1 1/16
	3 8	1 14/64
	4	1 17/64
	4 8	1 15/64
	5	1 17/64
1 inch	1 4	1 9/50
	1 8	1 3/16
	1 12	1 14/64
	*2	1¼
	2 4	1 7/64
	2 8	1 7/24
	3	1 1/32
	3 8	1⅜
	4	1 5/12
	5	1 17/32
	6	1 29/48
	7	1 21/32
	8	1¾
1¼ inch	1 12	1 5/12
	2	1 9/20
	2 4	1 15/32
	*2 8	1 31/64
	3	1 17/32
	3 8	1 37/64
	4	1⅝
	4 8	1 13/20
	5	1 7/10
	6	1¾
	7	1 13/16
	8	1 57/64
	9	1 31/32
1½ inch	2	1 8/12
	2 8	1 7/10
	3	1¾
	*3 8	1 25/32
	4	1 13/16
	4 8	1 27/32
	5	1 57/64
	6	1 61/64
	7	2 1/28
	8	2 3/32
	10	2 3/16
	12	2 5/16
1¾ inch	3	1 31/32
	4	2 1/32
	*5	2 3/32
	6	2 5/32
	8	2 17/64
	10	2 5/12
	12	2½

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
2 inch	3	2 1/16
	4	2¼
	5	2 5/16
	*6	2⅜
	7	2 5/12
	8	2 15/32
	9	2 17/32
	10	2 7/12
	12	2 11/16
	15	2 49/64
2½ inch	3 8	2 11/16
	5	2 25/32
	7	2 29/32
	8	2 11/12
	11	3
	14	3 1/16
	18	3⅓
3 inch	4	3 1/16
	5	3 7/32
	6	3 9/32
	8	3⅛
	10	3 13/32
	13	3½
	16	3 41/64
	17	3 11/16
	19	3¾
3½ inch	4 8	3 11/16
	6	3 23/32
	10	3⅞
	15	4
	19	4 1/12
4 inch	5	4 5/32
	6	4⅕
	8	4¼
	10	4 19/64
	12	4⅜
	18	4½
	21	4 15/24
4½ inch	7	4 1/16
	8	4 23/32
	14	4 57/64
	20	5
5 inch	8	5 13/64
	9	5 15/64
	15	5⅜
	22	5½
6 inch	10	6⅛
	12	6 3/16
	26	6½
	33	6¾

The weights with a * affixed are as light as should be used for Suction Pipes. We also make 7, 8, 10 and 12 in. diam. Lead Pipe (see pages 27 and 28) and can make, to order, any weight per foot required.

PURE BLOCK TIN PIPE.

LIST OF SIZES AND WEIGHTS.

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
3/32 inch	2¼	5/16
3/16 "	2¾	5/16
	5	5/12
7/32 inch	2¼	21/64
¼ inch	3	⅜
	4	27/64
	4¾	7/16
	6	15/32
	7	31/64
5/16 inch	7	33/64
⅜ inch	6	36/64
	8	39/64
	12	1 1/16
7/16 inch	4	35/64
½ inch	6	41/64
	8	1 1/16
	10	47/64
	12	¾
1		1 3/16
⅝ inch	10	1 3/16
1		57/64
1	4	1 7/32
¾ inch	12	59/64
1		1 7/32
1	4	1 9/32

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
1 inch	14	1⅛
	1 4	1 15/64
1¼ inch	1 4	1 7/16
	1 12	1 33/64
1½ inch	1 8	1 45/64
	2	1¾
2 inch	3	2 9/32
	4	2⅜

TIN-LINED PIPE.

LIST OF SIZES AND WEIGHTS.

☞ Order the same weight per foot of Tin-Lined Pipe as of Lead Pipe for the same purpose.

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
⅜ inch	10	9/16
	12	7/12
1		41/64
1	4	35/50
1	8	¾
½ inch	12	43/64
	14	7/10
1		34/48
1	4	49/64
1	8	13/16
1	12	41/48
2		⅞
2	8	46/48
3		1 1/48
⅝ inch	13	¾
1		1 3/16
1	4	27/32
1	8	57/64
1	12	59/64
2		48/50
2	4	1
2	8	1 1/24
2	12	1 1/20
3		1 5/64
3	4	1⅛

Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
⅝ inch	3 8	1 3/20
	4	1⅕
¾ inch	1	58/64
	1 4	48/50
	1 8	63/64
	1 12	1 1/64
	2	1 1/16
	2 4	1 5/64
	2 8	1⅛
	3	1 1/16
	4	1 17/64
	4 8	1 15/48
	4 12	1 23/64
	5	1 17/48
1 inch	1 8	1 3/16
	1 12	1 14/64
	*2	1¼
	2 8	1 7/24
	3	1 11/32
	4	1 5/12
	5	1 17/32
	6	1 29/48
	7	1 21/32
1¼ inch	*2 8	1 31/64
	3	1 17/32

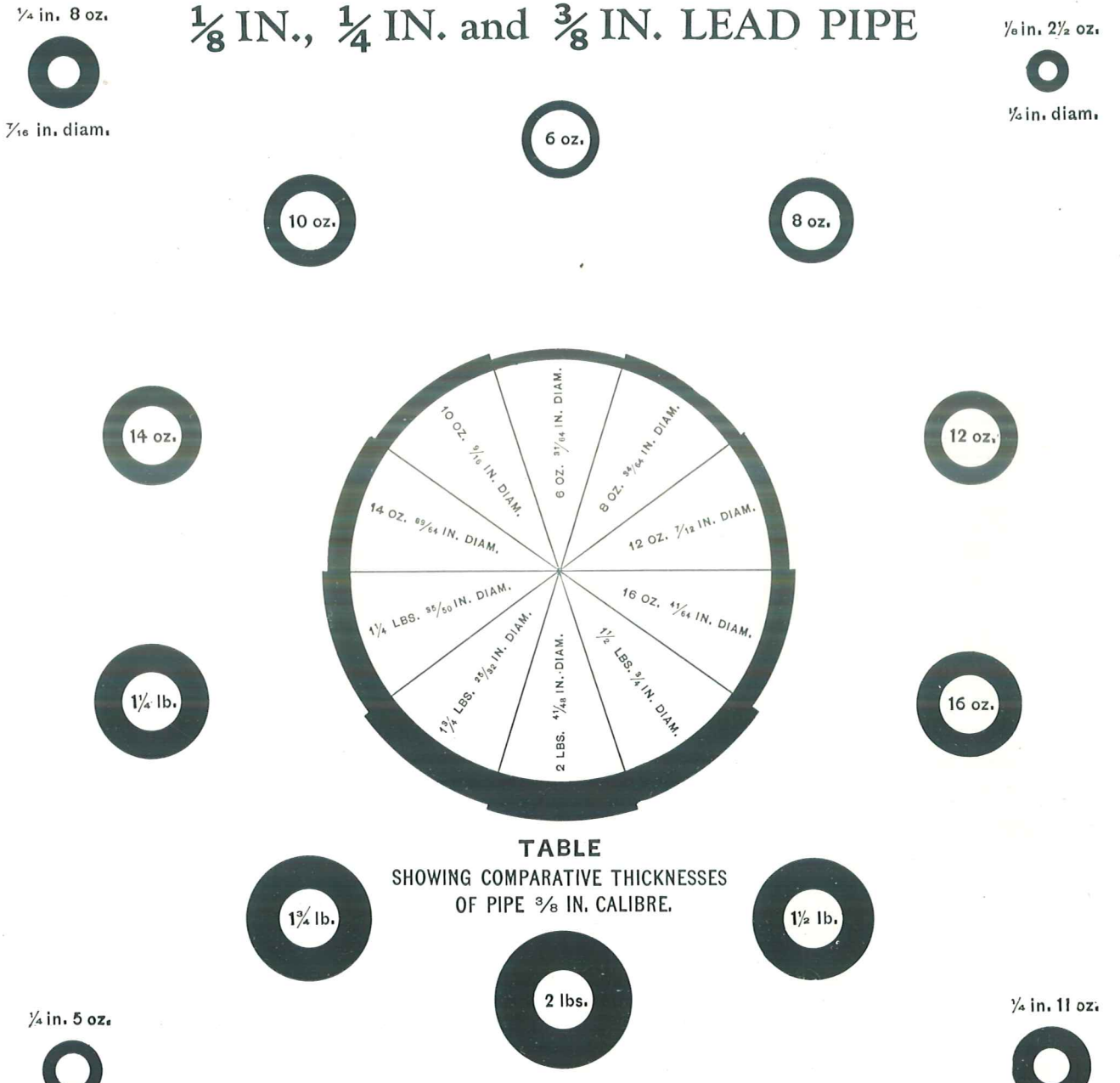
Calibre.	Weight per foot. lbs. oz.	Outside diameter. in.
1¼ inch	3 8	1 37/64
	4	1⅝
	4 8	1 13/20
	5	1 7/10
	6	1¾
	9	1 31/32
1½ inch	*3 8	1 25/32
	4	1 13/16
	4 8	1 27/32
	5	1 57/64
	6	1 61/64
	10	2 3/16
	12	2 5/16
1¾ inch	4	2 1/32
	*5	2 3/32
	6	2 5/32
	8	2 17/64
2 inch	5	2 5/16
	*6	2⅜
	7	2 5/12
	8	2 15/32
	10	2 7/12
	12	2 11/16
	15	2 49/64

SHEET TIN.

We make a specialty of rolling Sheets from Pure Block Tin, any required gauge.

3/8 DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 3/8

1/8 IN., 1/4 IN. and 3/8 IN. LEAD PIPE

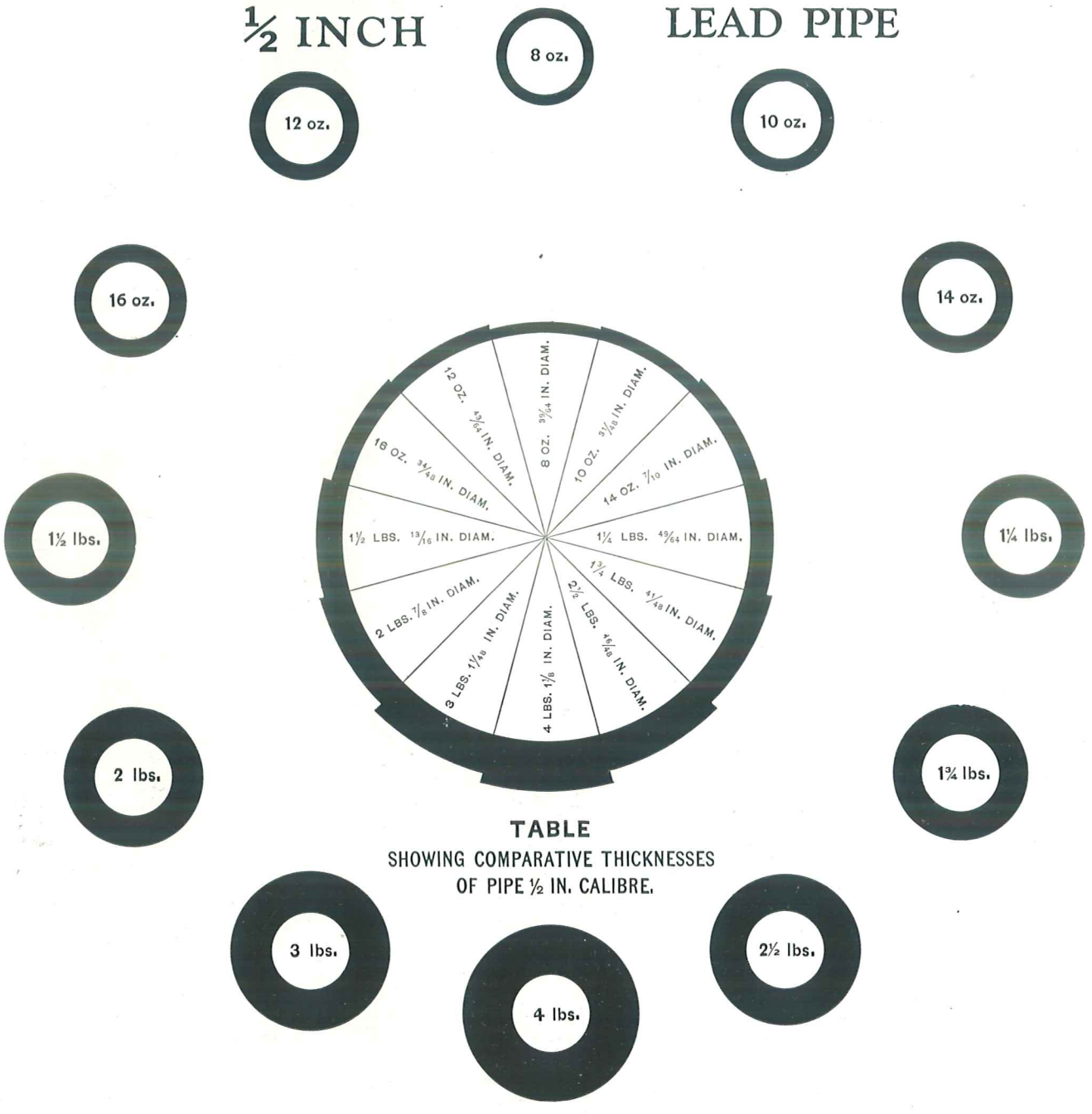


TABLE

SHOWING COMPARATIVE THICKNESSES OF PIPE 3/8 IN. CALIBRE.

½ DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF ½

½ INCH LEAD PIPE

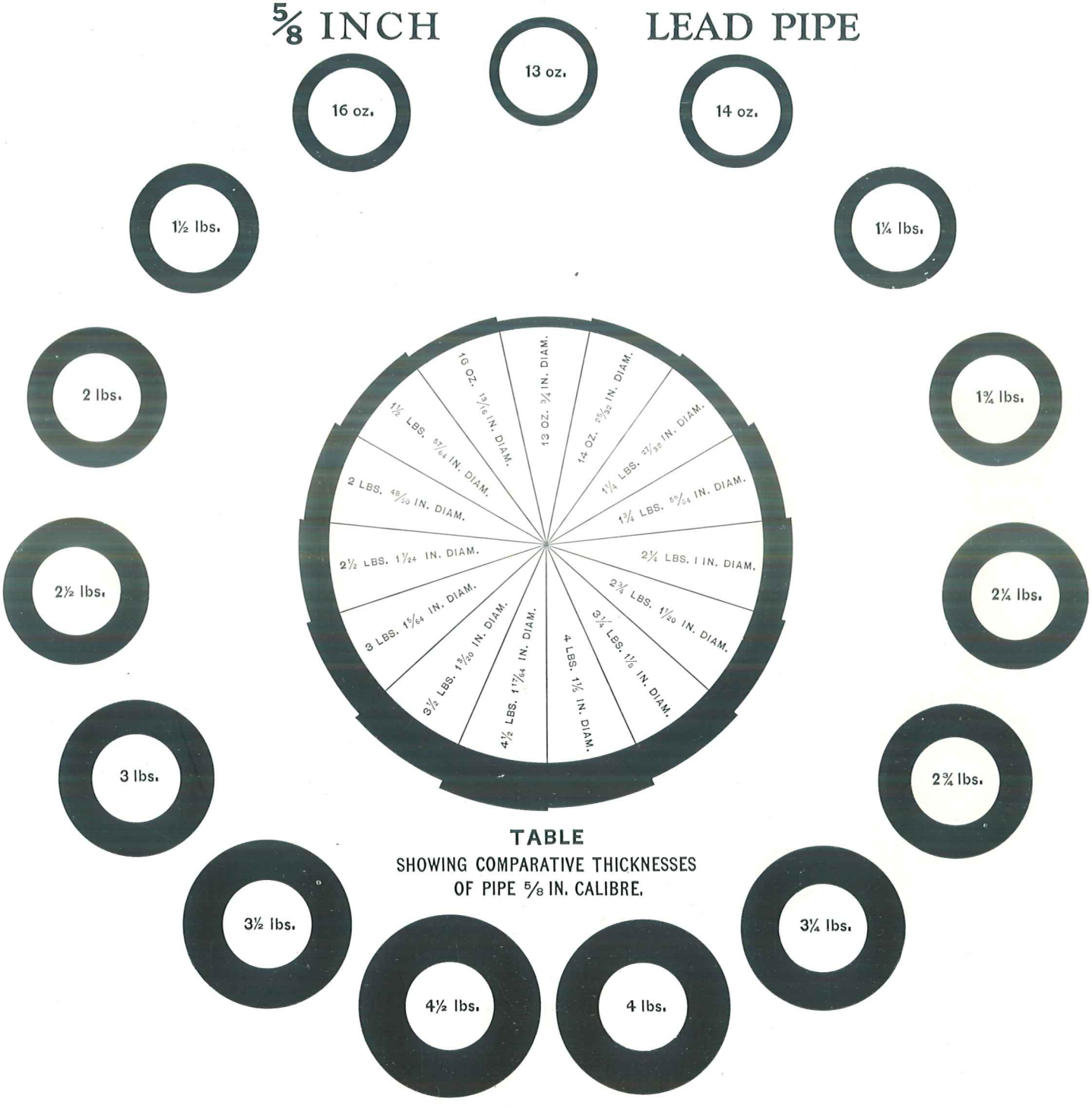


TABLE

SHOWING COMPARATIVE THICKNESSES
OF PIPE ½ IN. CALIBRE.

5/8 DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 5/8

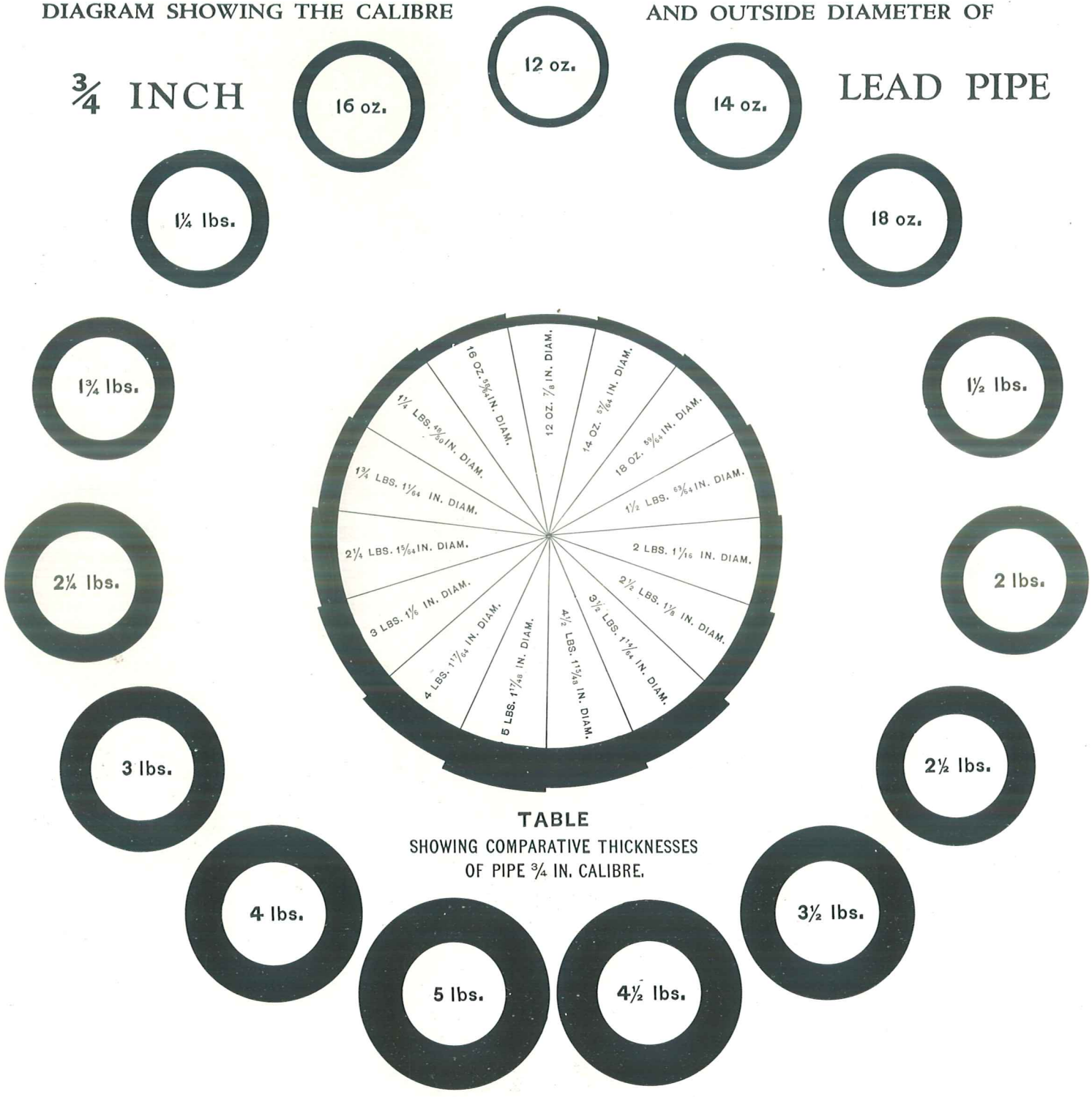
5/8 INCH LEAD PIPE



TABLE

SHOWING COMPARATIVE THICKNESSES
OF PIPE 5/8 IN. CALIBRE.

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF ¾ INCH ¾ LEAD PIPE



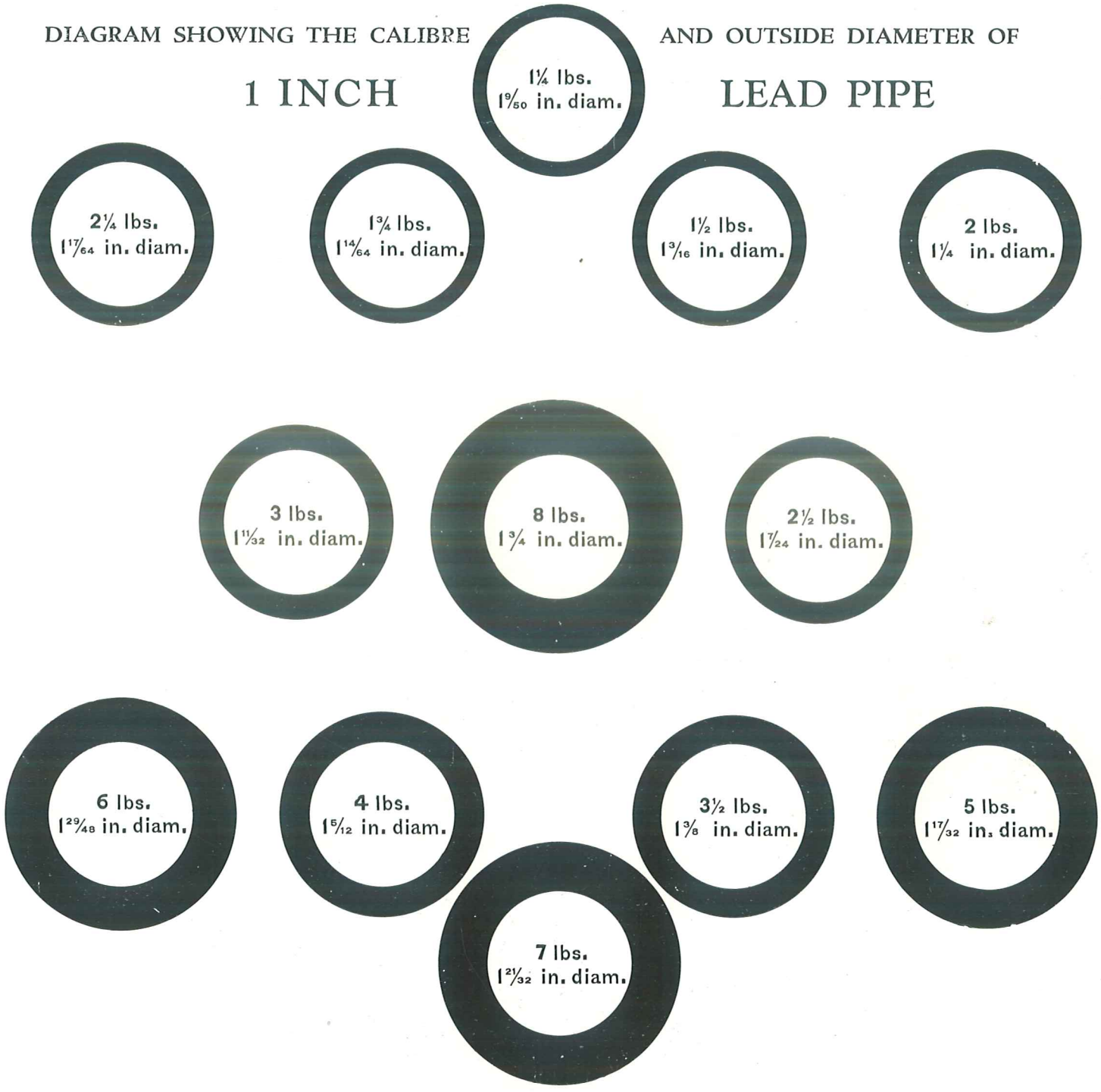
TABLE

SHOWING COMPARATIVE THICKNESSES
OF PIPE ¾ IN. CALIBRE.

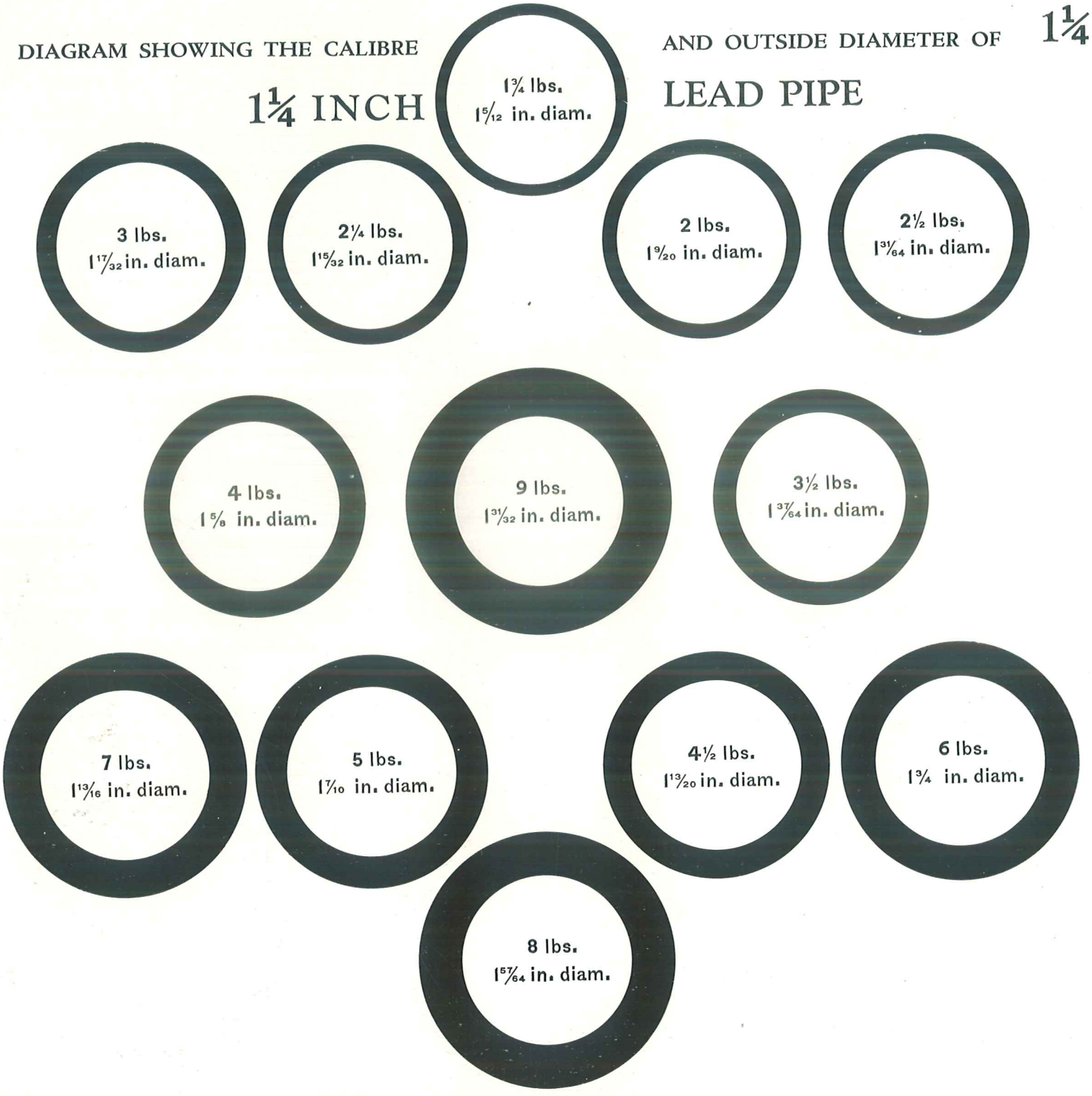
1 1

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

1 INCH LEAD PIPE

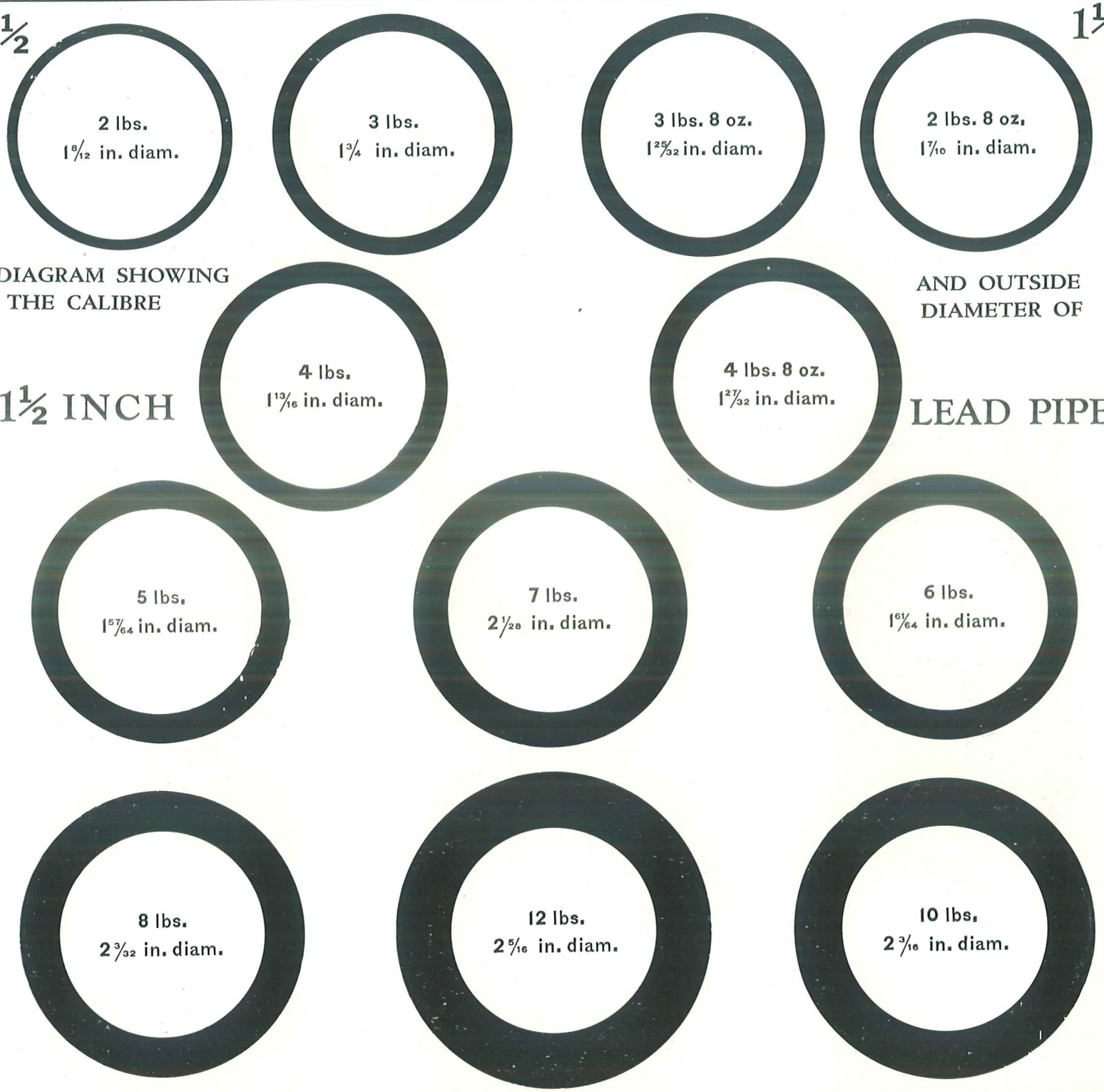


1¼ DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 1¼ 1¼ INCH LEAD PIPE



1½ INCH LEAD PIPE

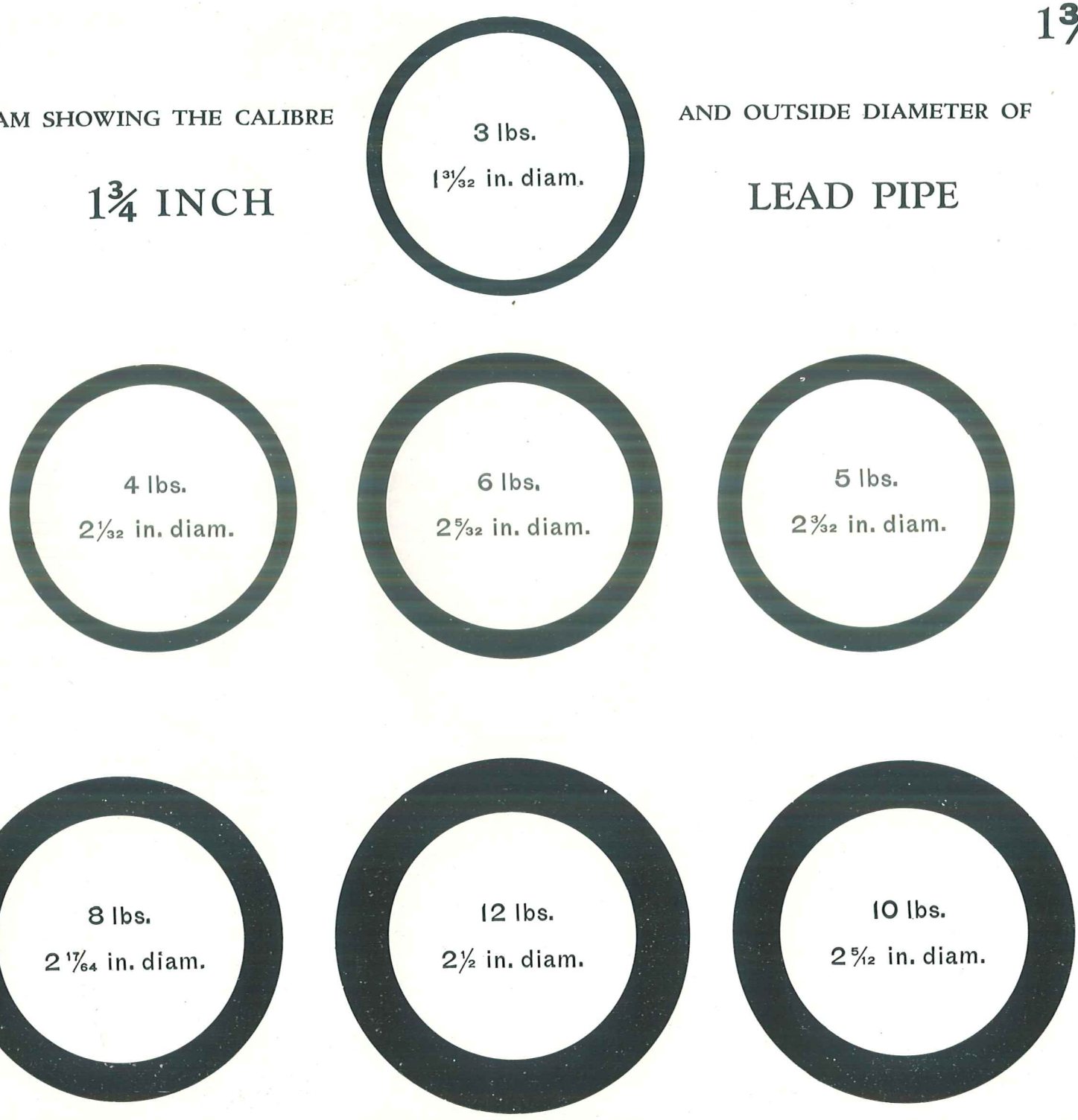
DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 1½



1¾ 1¾

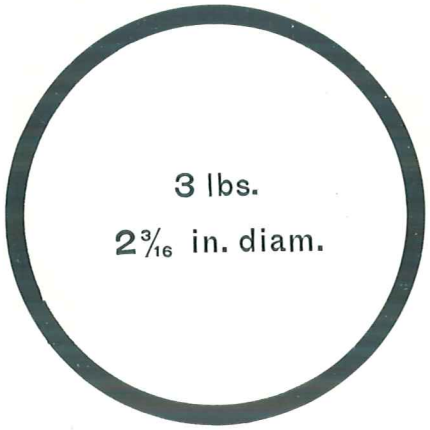
DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

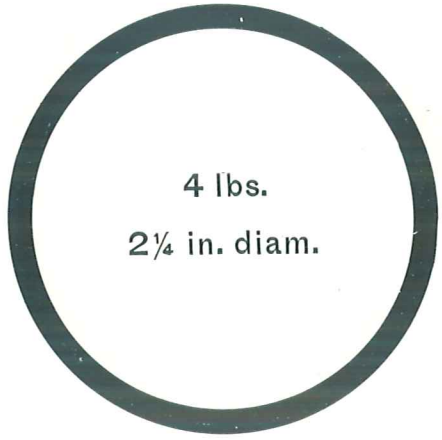
1¾ INCH LEAD PIPE

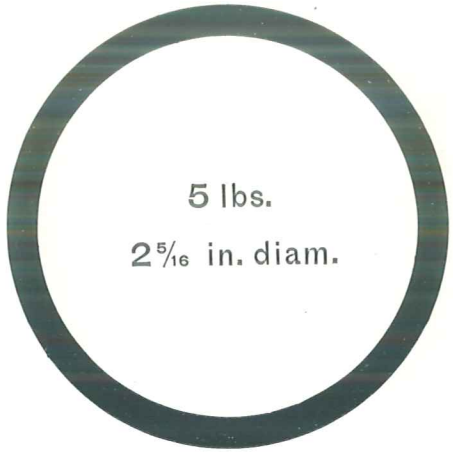


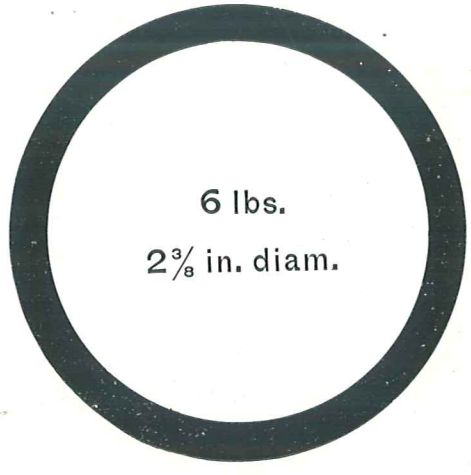
2 DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 2

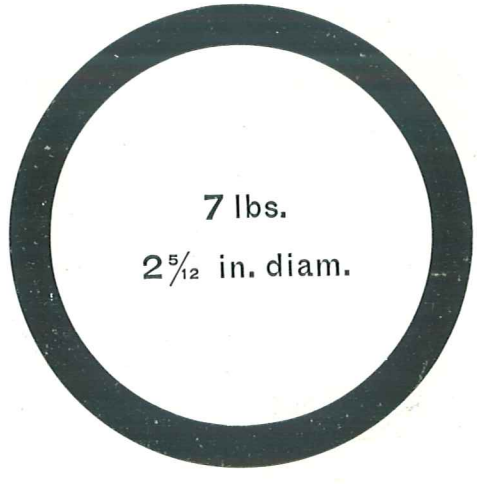
2 INCH LEAD PIPE







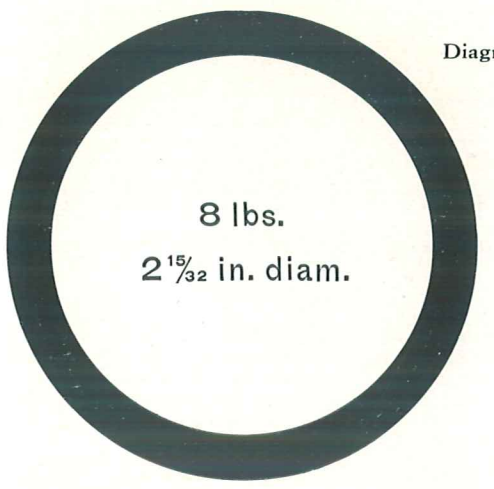


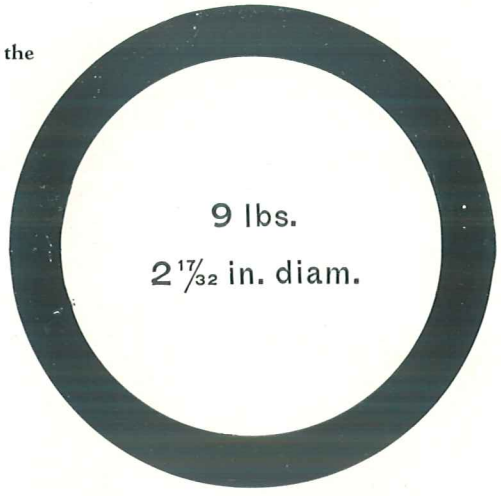


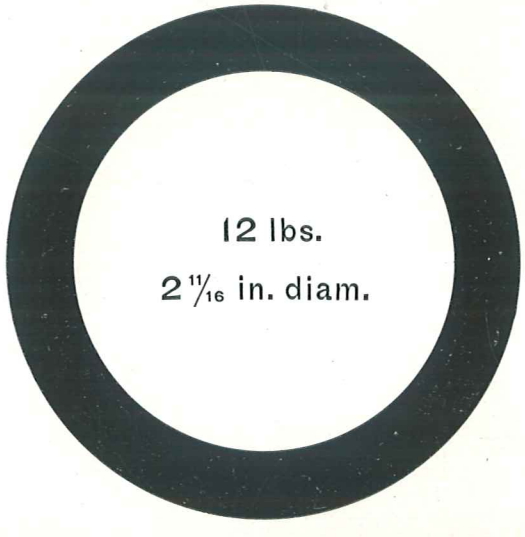
2 2

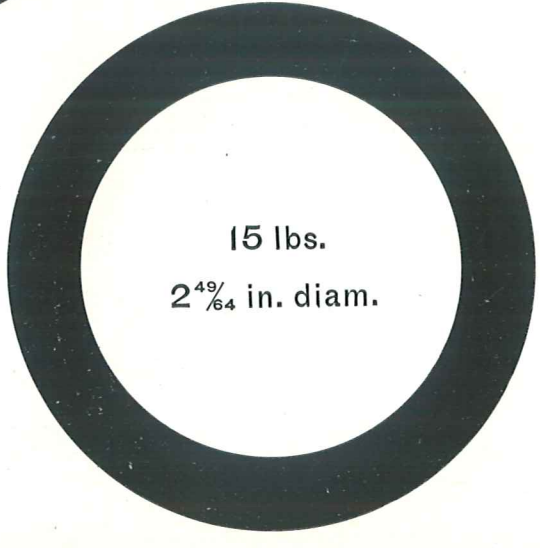
Diagram (Continued) Showing the Calibre and Outside Diameter of

2 INCH LEAD PIPE



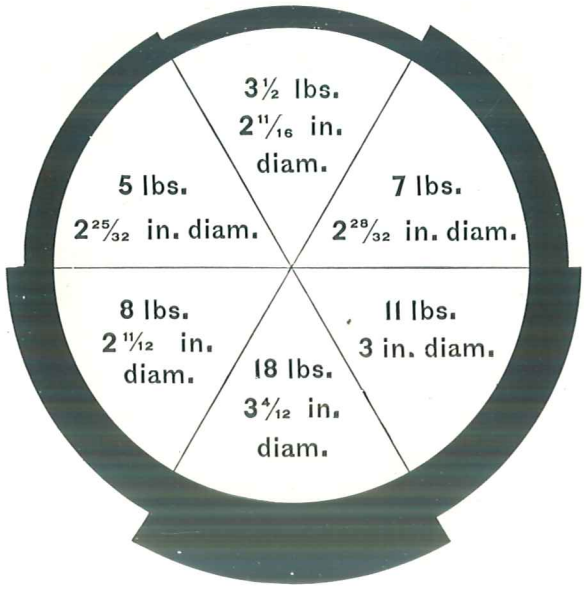


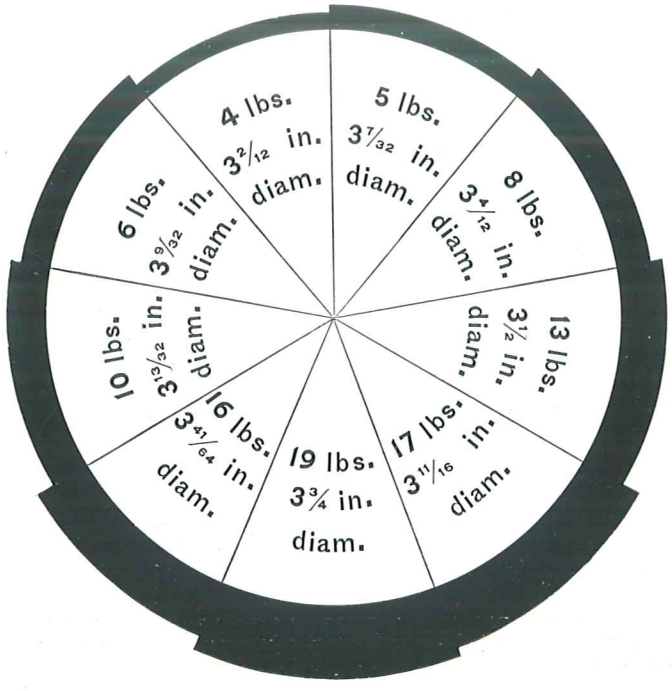




2½ DIAGRAMS SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 3

2½ AND 3 INCH LEAD PIPE





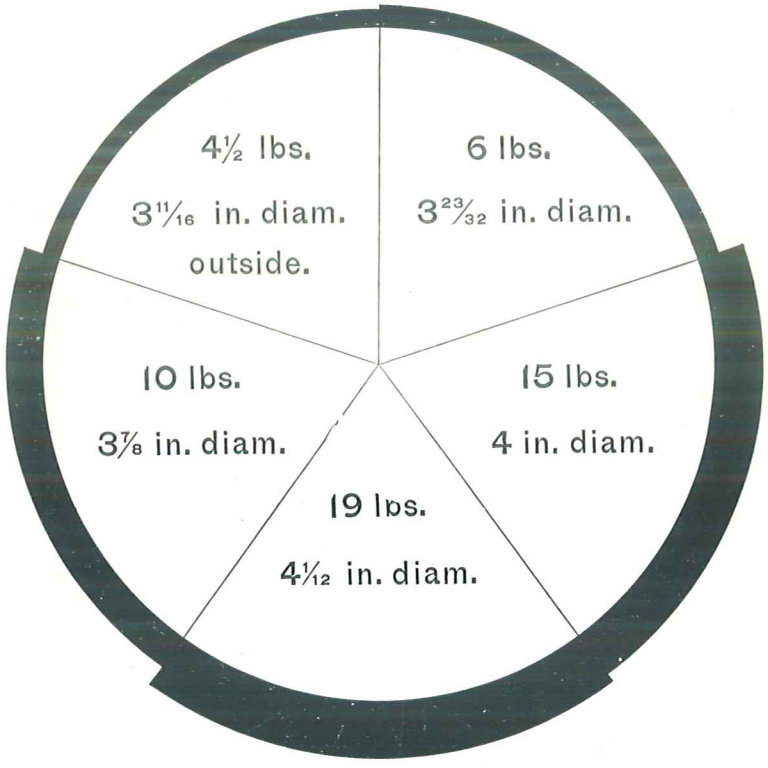
(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)

3½ 3½

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

3½ INCH LEAD PIPE

(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)



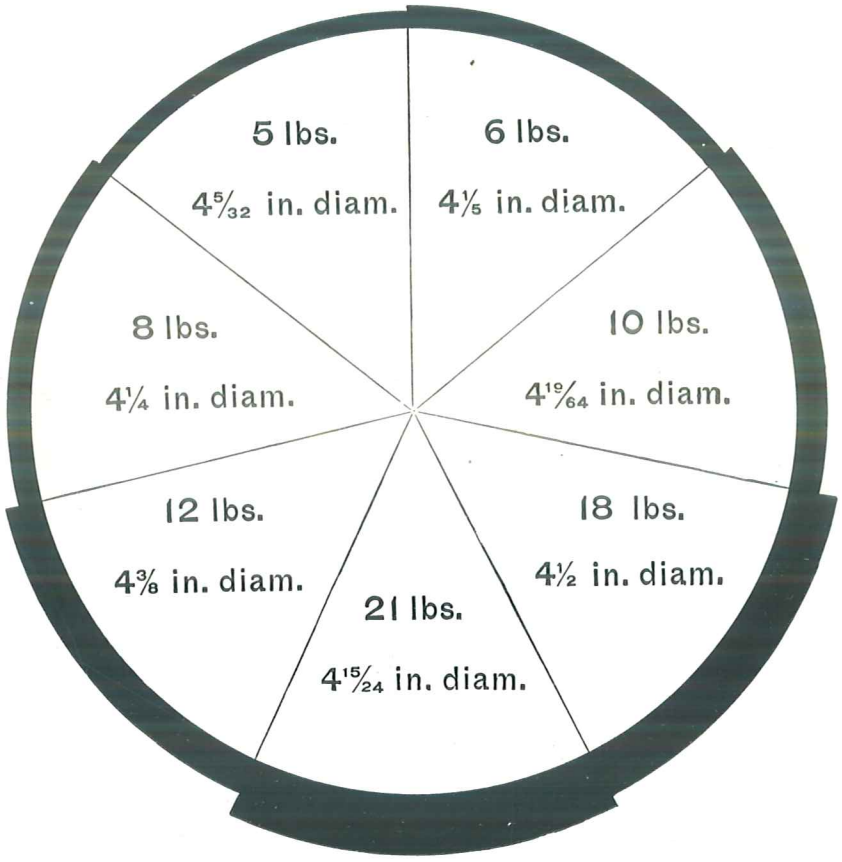
COMBINATION FERRULES, DRUM TRAPS, CLEAN SWEEP TRAPS,
LEAD WOOL, LEAD WIRE, LEAD CAMES

4 4

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

4 INCH LEAD PIPE

(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)



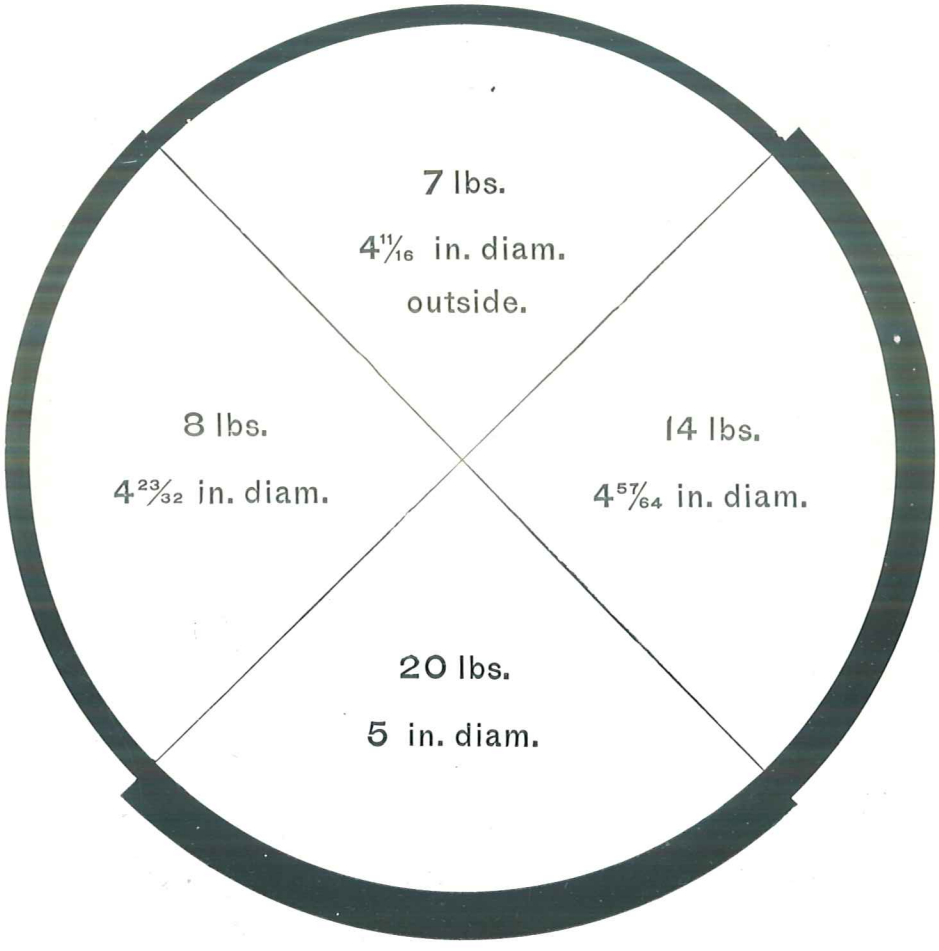
Bar Lead, Block Lead, Car Seals and Wires, Bar and Block Tin, Plumbing Solder, Fine Solder, Copper and Iron Pumps and Fittings

4½ 4½

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

4½ INCH LEAD PIPE

(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)

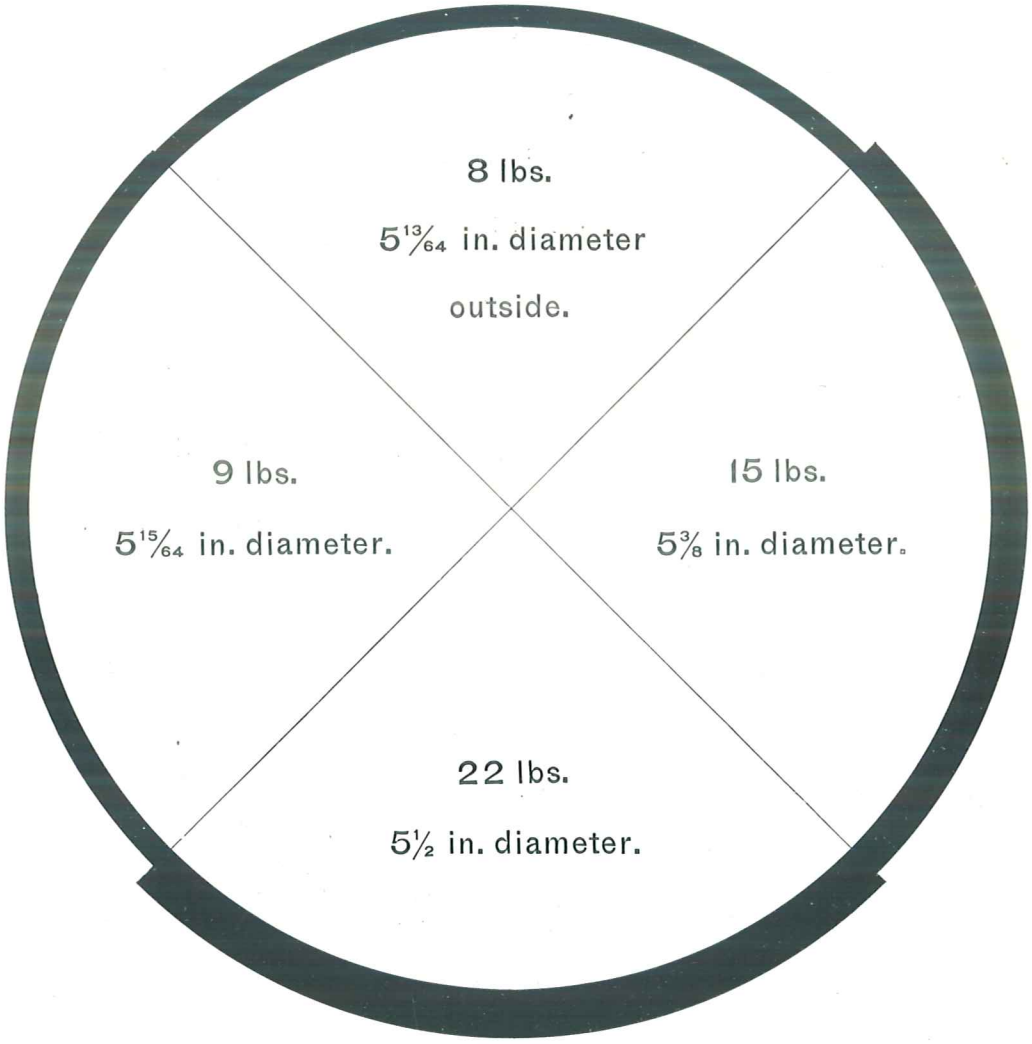


5 5

DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

5 INCH LEAD PIPE

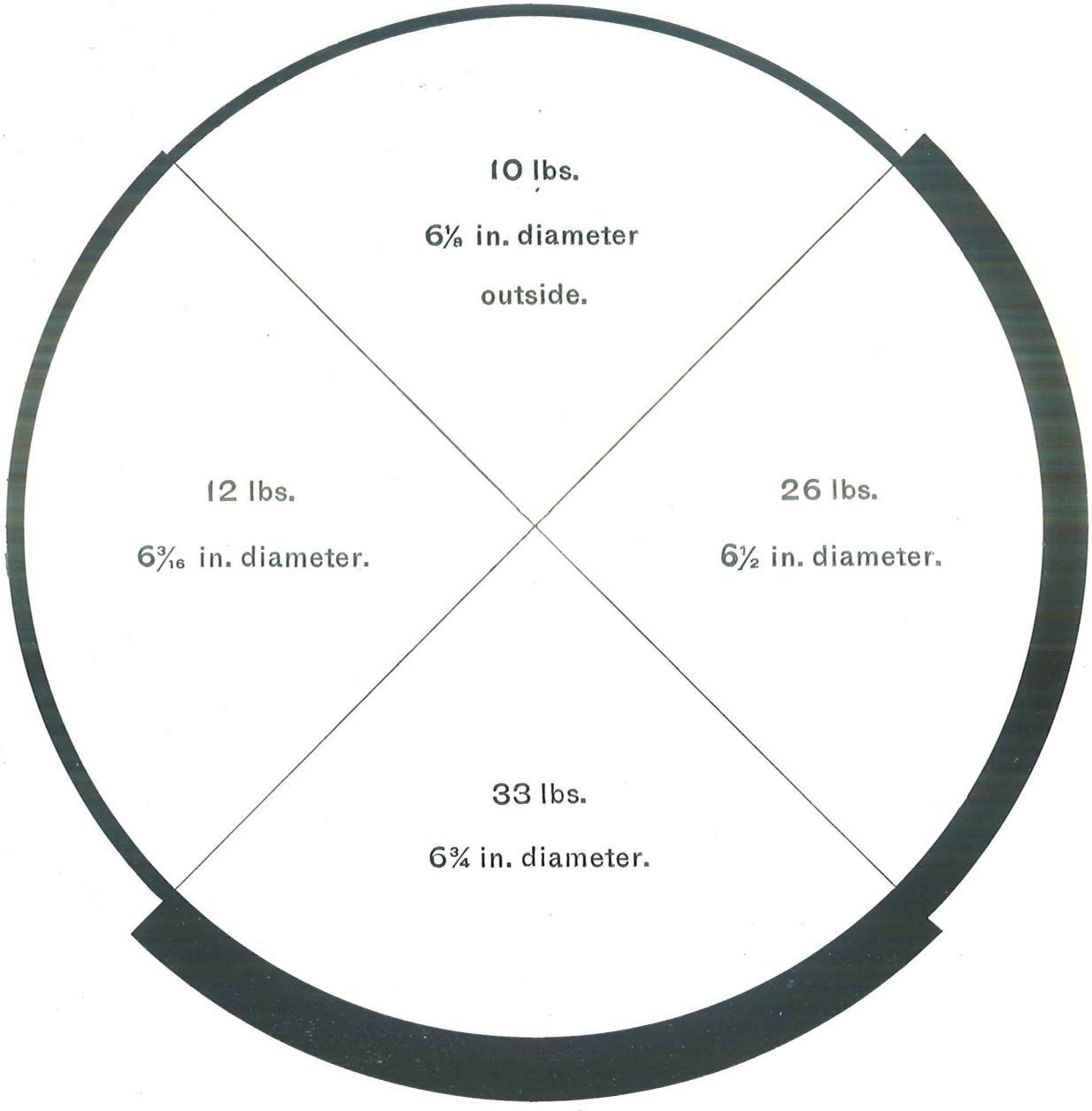
(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)



6 DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF 6

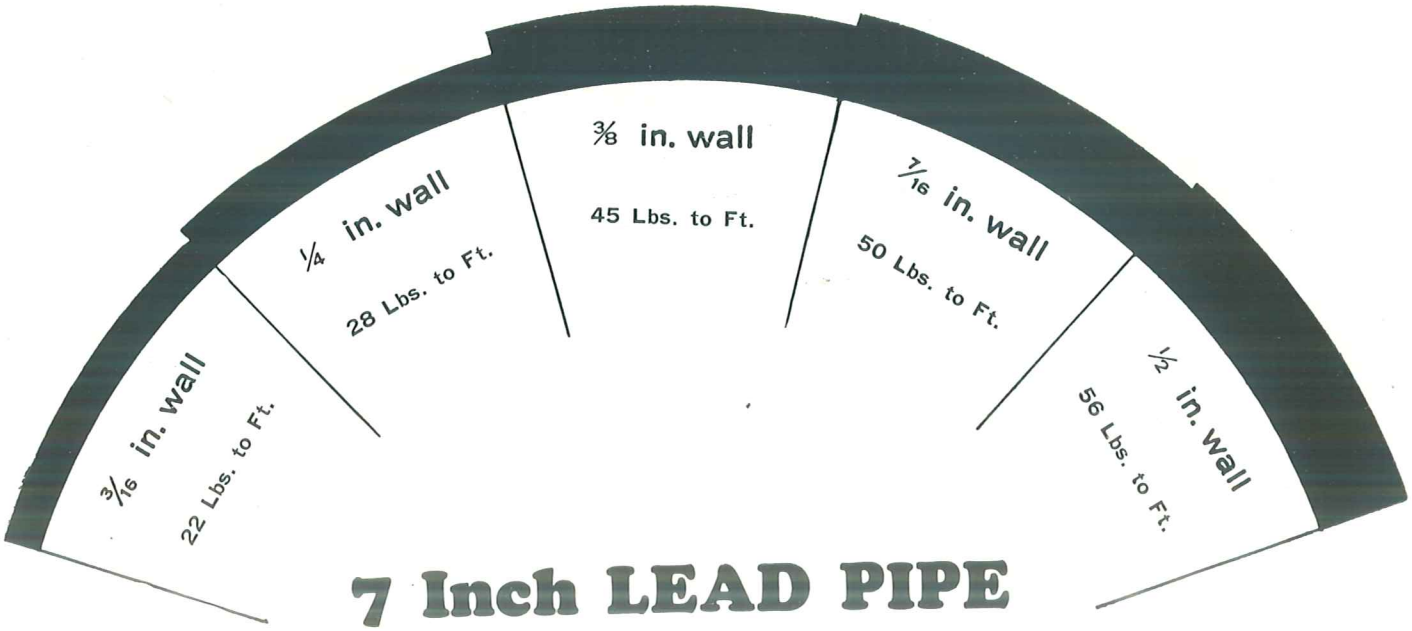
6 INCH LEAD PIPE

(Sectional Figures show Different Weights per Foot, and Outside Diameter of each)



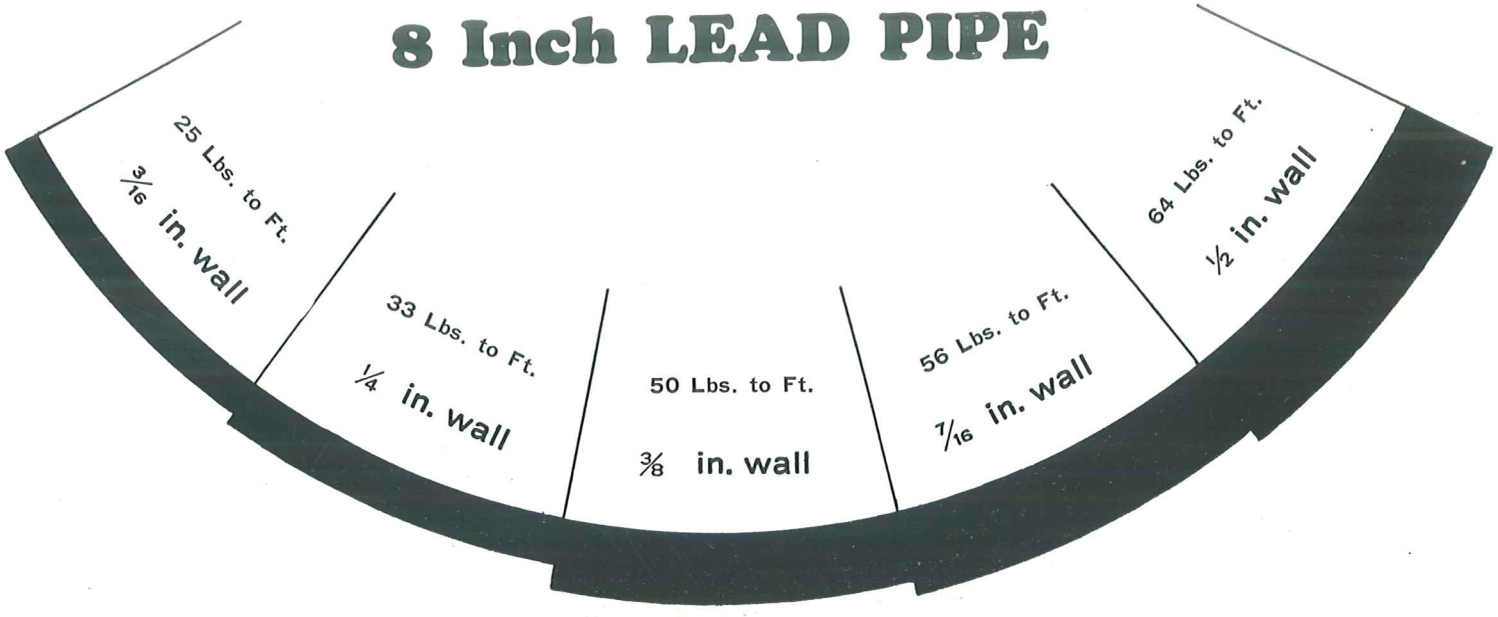
7

7



7 Inch LEAD PIPE

8 Inch LEAD PIPE



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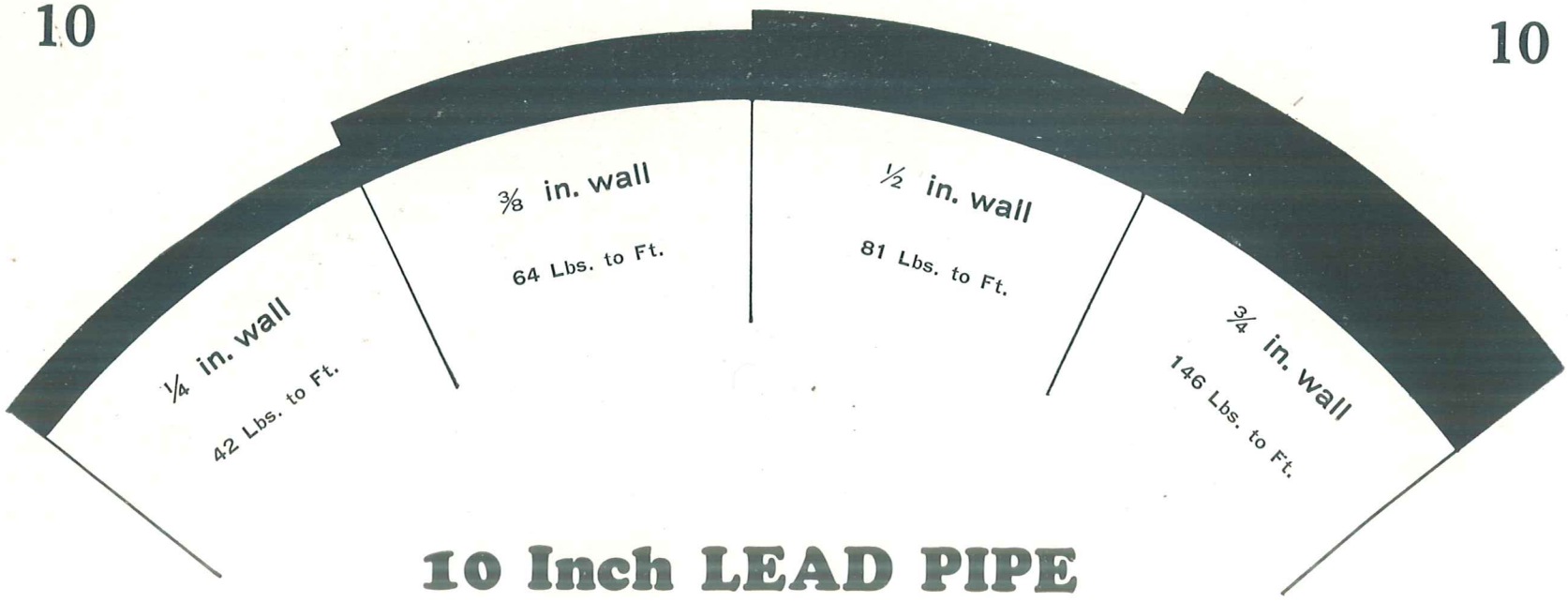


10 Inch LEAD PIPE

12 Inch LEAD PIPE

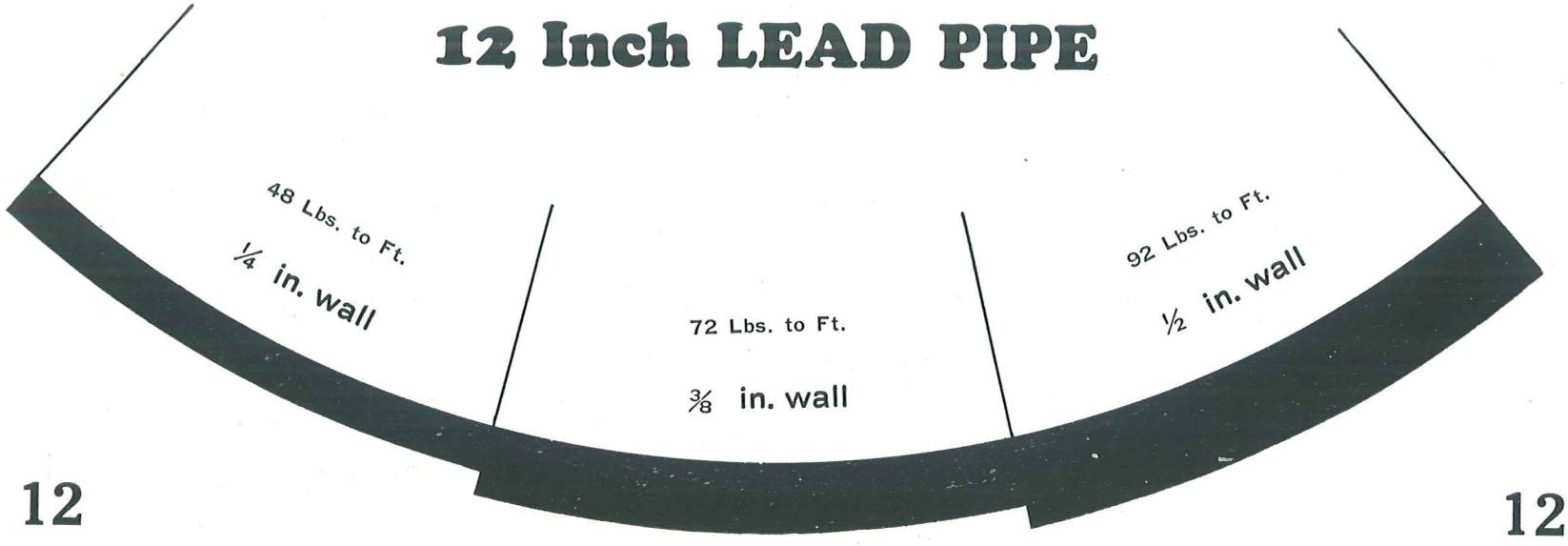
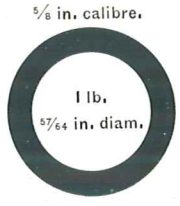
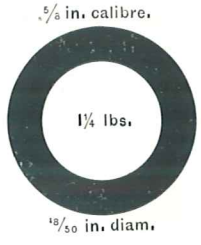


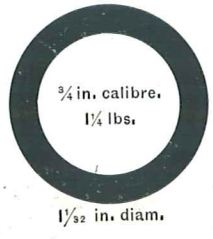
DIAGRAM SHOWING THE CALIBRE AND OUTSIDE DIAMETER OF

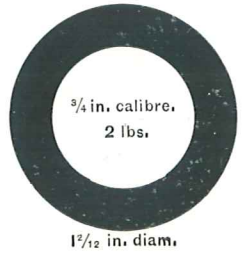
BLOCK TIN PIPE

3/16 in. to 3/4 in. inclusive





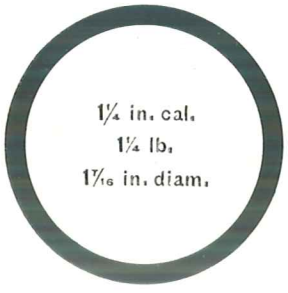


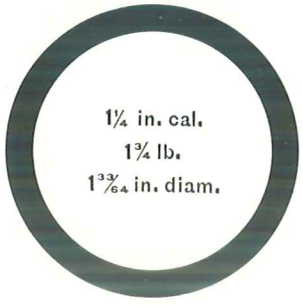


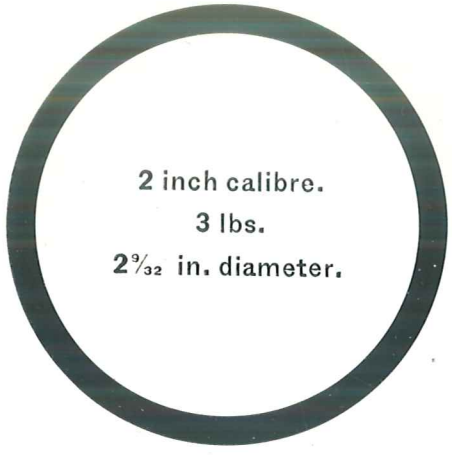
BLOCK TIN PIPE

1 inch to 2 inch inclusive

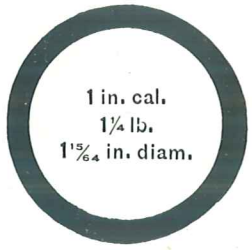
1, 1¼

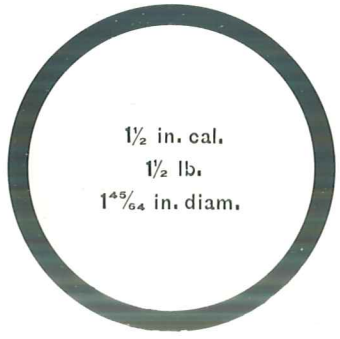


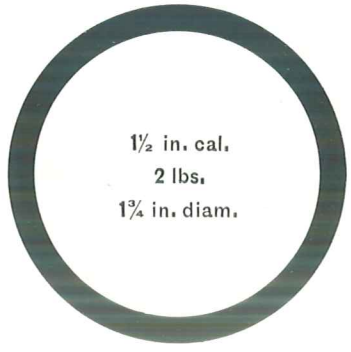


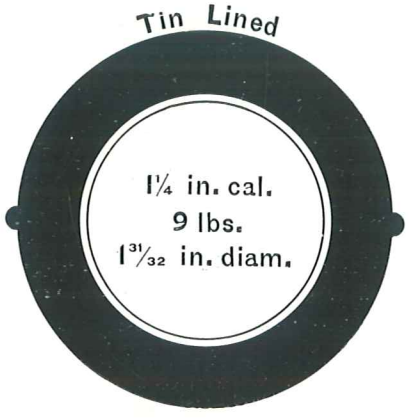


1½, 2









TIN LINED PIPE

Tin Lined Pipe is same outside diameter as Lead Pipe of corresponding sizes and weights per foot. Only two diagrams are given in which is shown, by hair line, the internal lining of Tin, and the ribs which extend lengthwise on the outside surface to distinguish it from Lead Pipe when interior cannot be seen.

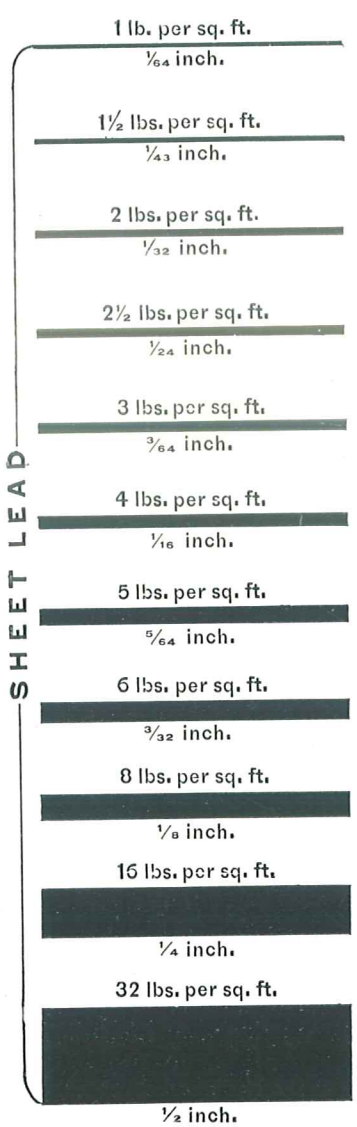
DIAGRAMS SHOWING COMPARATIVE THICKNESS OF

SHEET LEAD

FROM 1 POUND TO 32 POUNDS TO THE SQUARE FOOT

SHEET TIN

FROM 1 POUND TO 20 POUNDS TO THE SQUARE FOOT



SHEET LEAD.

WEIGHT per square foot: 2, 2½, 3, 3½, 4, 4½, 5, 6, 7, 8, 9, 10 pounds and upwards.

We furnish Sheet Lead as follows:

ROLLS SHEET LEAD from 2 lbs. per square foot and upwards, 2 to 9 feet wide.

ROLLS IN BOXES—2 lbs. per square foot and upwards about 2 feet wide, put up in Boxes as follows, viz.:

1 Box containing two 50 lb. Rolls.
1 Box containing one 100 lb. Roll.
1 Box containing two 100 lb. Rolls.
1 Box containing one 150 lb. Roll.

No charge for boxes for SHEET LEAD four feet wide and under. Rolls over 4 feet wide boxed when desired at moderate cost.

DIMENSION SHEETS—Rolled to order when desired, without extra charge.

Particular attention given to rolling Dimension sheets for Chemical Manufacturers, Oil Refiners, etc.

SHEET LEAD ON REELS—2 and 2½ lbs. per square foot and upwards, made in strips, ½, ⅝, ¾, 1, 2, 2½, 3, 4, 5, 6, 7, 8, 9, 10 11, and 12 inches wide, wound on small reels, weighing from 100 to 250 lbs. each.

These strips are of the different widths usually required by Builders, Roofers, and Curtain Fixture Manufacturers, and will be found very convenient, taking up very little room in the store or shop, besides saving much time and labor in cutting from sheets.

☞ By our Patent Process of Manufacture we give the strips a *perfectly smooth surface.*

☞ In ordering Sheet Lead, much time and trouble will be saved, and mistakes avoided, if our customers will state—

1st. WEIGHT PER SQUARE FOOT WANTED.

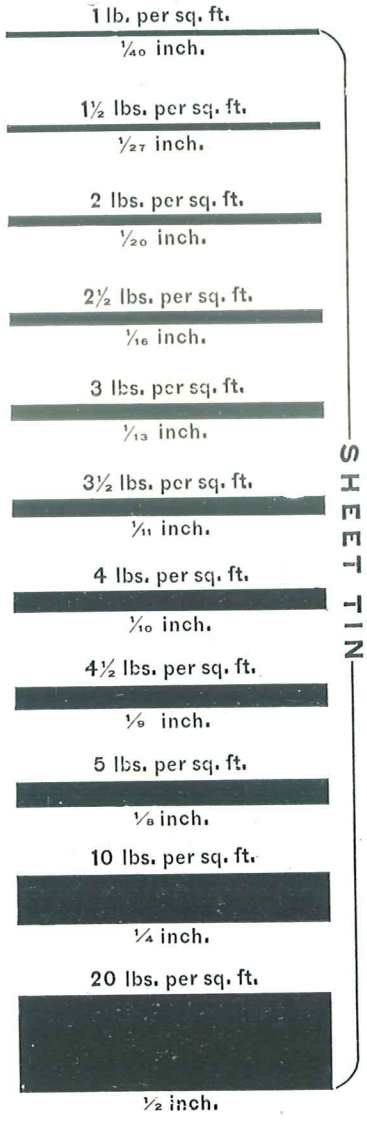
2d. IF ROLLS, WEIGHT DESIRED.

3d. IF BOXED, WEIGHT DESIRED AND NUMBER OF ROLLS IN BOX.

4th. IF ON REELS, WIDTH OF STRIP, AND WEIGHT PER FOOT.

5th. IF DIMENSION, STATE PLAINLY IN FEET AND INCHES.

6th. SHIPPING DIRECTIONS IN FULL.



SHOT

Sizes	Diam.	No. Drop Shot to Oz.	No. Chilled Shot to Oz.
No. 12	.05	2326	2385
No. 11	.06	1346	1380
No. 10½	Trap	1056	1130
No. 10	.07	848	868
No. 9½	Trap	688	716
No. 9	.08	568	585
No. 8½	Trap	472	495
No. 8	.09	399	409
No. 7½	Trap	338	345
No. 7	.10	291	299
No. 6	.11	218	223
No. 5	.12	168	172
No. 4	.13	132	136
No. 3	.14	106	109
No. 2	.15	86	88
No. 1	.16	71	73
No. B	.17	59	**
No. BB	.18	50	**
No. BBB	.19	42	**
No. T	.20	36	**
No. TT	.21	31	**
No. F	.22	27	**
No. FF	.23	24	**

**Not made in these sizes.

BUCK SHOT

Sizes	Diam.	Balls to Lb.
No. 4C	.24	337
No. 3C	.25	295
No. 2C	.27	237
No. 1C	.30	173
No. O	.32	142
No. OO	.34	118
No. OOO	.36	100
No. Balls	.38	85
No. Balls	.44	50

DUST SHOT

Size	Dia.	Shot to oz.
Dust	.04	4565

In ordering, state whether "Drop," "Chilled," "Buck," or "Trap" Shot is wanted, giving numbers as per above lists.

Put up in 25 and 5-pound bags.

The "Tatham" Shot will be found *unsurpassed* by any other brand in the market, being manufactured by the latest improved machinery, and the greatest care used in sorting, sizing and finishing. It is sufficiently hard to stand the concussion of firing without becoming flattened; consequently will "carry" well and *kill* instead of *wounding* the game.

Our *"Extra" Clean Finish* prevents *leading* or *corroding* the gun.

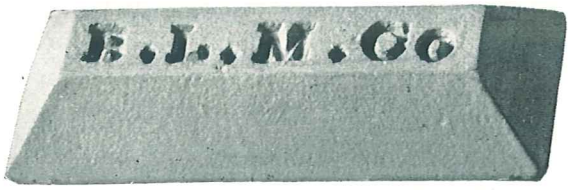
TATHAM AIR RIFLE SHOT

This is a special size of shot for air rifles; put up in 5 and 25 pound bags.

It is also put up in two sizes BOY SCOUT cartridges, and 1 pound boxes.

CLOSED OPEN

SOLDERS



"B. L. M. Co." Wiping Solder meets the most exacting needs of high-grade work.

It will stand the addition of considerable lead to reduce its quality to that of the average wiping solder.

"B. L. M. Co." is very popular with all classes of plumbers, and we guarantee always to maintain its high standard of quality.

"Number 1" Wiping Solder contains less tin than "B. L. M. Co.," but gives perfect satisfaction when used where the best grade is not demanded.

Chadwick-Boston Lead Co. Extra Fine Stick Solder. One-half lead and one-half tin. Average weight, 6½ ounces. Heavier sticks made to order.

This solder is made from absolutely new refined metals, has a low melting point and that smooth-flowing quality which assures good work with economy of time and material.

Special Fine Solder. This Solder is one of our best sellers, cheaper than our Extra Fine, but guaranteed to give satisfaction.

Boston No. 1 Stick Solder is designed for use where a little bulk is necessary to strengthen the joint.

We can furnish the competitive brands of solder: Warranted ½ & ½, Strictly ½ & ½, Special Fine, Half and Half, etc.

We also manufacture a full line of ribbon, triangular, half-round and wire solders, in the various sizes and grades.

All our solders are made by experienced men from carefully refined new metals.

ROSIN CORE SOLDER

for Radio Manufacturers

1, 5 and 10 lb. spools.

METALS

BABBITT METAL

GOVERNMENT
Highest grade. Particularly adapted to high speeds.

EXTRA FINE
Copper hardened. Good for any service.

RELIABLE
For car bearings or slow and heavy work.

MEDIUM
For light work.

These are our standard brands of Babbitt Metal regularly carried in stock. We will be glad to quote prices on Special Formulas according to customers' requirements.

TEMPERITE

FOR FINE TEMPERING OF TOOLS

Made from triple refined metal into blocks weighing about 50 pounds each.

CALKING LEAD

Our Ingot Lead is cast from best brands of new soft pig lead. It flows freely and is easily calked with less dross waste than results from use of old lead or remelted scrap.

BALLAST LEAD

12, 20, 40, 70 and 100 lb. Pigs

PURE BLOCK TIN

We sell Straits Tin in the original pig, or cast into cakes and bars.

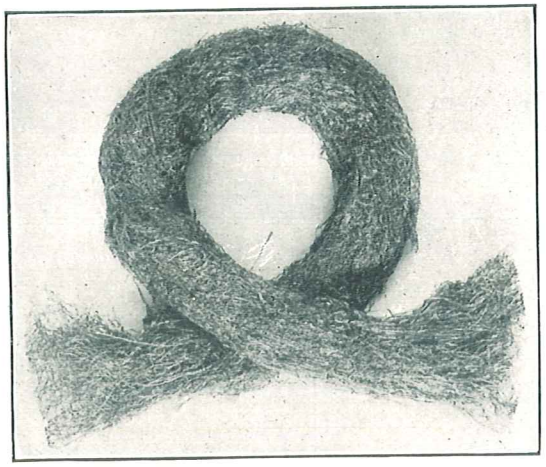
PIG LEAD **SPELTER**

ANTIMONIAL LEAD **MIXED METALS**

ANTIMONY **TIN** **CASTINGS**

BATTERY LEAD

Hard Lead in pigs or blocks, for battery manufacturers.



LEAD WOOL

For calking joints under water; in cast iron gas or water pipes and pipes subject to vibration.

For emergency leaks in plumbing and in steam or hot water pipes; for leaks in any pipes, brick sewers, etc. for leaks in skylights.

For pointing stone monuments, walls, etc.

For holding bolts in walls, railroad ties, floors, etc.

Approximate quantities of lead wool and yarn required for cast-iron pipe joints.

FOR PRESSURE UP TO 500 POUNDS

LEAD WOOL		YARN		LEAD WOOL			YARN
DIAM.	DEPTH	WT. LBS.	DEPTH	DIAM.	DEPTH	WT. LBS.	DEPTH
2	1	2.	2	14	1¼	16	3
3	1⅛	3.	2	15	1¼	18	3
4	1⅛	4.5	2	16	1¼	20	3
5	1⅛	5.5	2½	18	1⅜	22	3
6	1⅛	6.5	2⅝	20	1⅜	25	3⅜
7	1⅛	8.5	2⅝	24	1⅜	36	3⅜
8	1⅛	9.	2¾	30	1½	45	3⅜
9	1⅛	11.	2⅝	36	1⅝	60	3⅝
10	1⅛	12.5	2⅝	42	1⅝	75	3¾
12	1⅛	14.	2⅝	....	....	....	....

Put up in bags of 50 pounds.

Lead Wool is treated more extensively in a separate booklet which will be furnished upon request.

LEAD-LINED WOODEN TANKS

For electro plating and general chemical uses.

Tanks lined with acid-resistant chemical or hard lead. SEAMS BURNED, not soldered.

Prices quoted upon receipt of specifications.

WEDGE LEAD

FOR POINTING MONUMENT, STONE WALLS, ETC.

No.	1	2	3	4	5	6
WID.	½″	7/16″	17/32″	5/8″	7/8″	1¼″
APP. WT. PER LINEAR FT.	3 oz.	3½ oz.	4½ oz.	6½ oz.	7 oz.	11 oz.

Our Wedge Lead is usually put up on reels containing about 100 pounds each.

This is a safe and convenient form for shipment as well as an economical package from which the material may be used as required without waste.

The diagrams here shown represent the sizes generally used for monumental work, etc. Other sizes and shapes manufactured to order.

LEAD WIRE—Common Sizes

⅛ in. — 16 ft. to the lb.
¼ " — 4 " " " "
⅜ " — 2 " " " "

STUBS GAUGE	SIZE IN DECIMALS	APP. EQUIVALENT IN B. & S. GAUGE	APP. NO. FEET TO ONE LB.
12	.104	10	24
13	.092	11	31
14	.080	12	40
15	.072	13	50
16	.064	14	63
17	.056	15	82
18	.048	16	112
19	.040	18	162
20	.036	19	200
21	.032	20	252
22	.028	21	330
23	.024	22	448
24	.022	23	533
25	.020	24	646

WE MAKE TO ORDER

BALLAST LEAD - CHANNEL LEAD - COD LEADS
FUSE WIRE - GASKETS - MOULDINGS - NET LEADS
SEALS - SOUNDING LEADS - WASHERS - WEIGHTS

SPECIAL INFORMATION

SPECIFIC GRAVITIES AND WEIGHTS

Metals	Pound per Cu. In.	Pounds per Cu. Ft.	Specific Gravity
Aluminum—Cast	.092	159	2.55
Aluminum—Hammered	.099	172	2.75
Aluminum—Rolled	.098	169	2.70
Aluminum—Wire	.098	169	2.70
Aluminum—Bronze	.278	481	7.70
Antimony	**.242**	**418**	**6.70**
Bismuth	.354	612	9.80
Brass, .70 Cu, .30 Zn—Cast	.293	506	8.10
Brass, .70 Cu, .30 Zn—Rolled	.307	531	8.50
Brass, .85 Cu, .15 Zn—Rolled	.309	534	8.55
Bronze, .90 Cu, .10 Sn	.318	549	8.80
Cadmium	.313	540	8.65
Cobalt	.314	543	8.70
Copper—Cast	.314	543	8.70
Copper—Hammered	.323	559	8.95
Copper—Rolled	.322	556	8.90
Copper—Wire	.323	559	8.95
Gold	.697	1205	19.30
Iron—Gray Pig	.257	443	7.10
Iron—White Pig	.275	474	7.60
Iron—Wrought	.278	480	7.70
Iron—Steel	.283	490	7.85
Iron—Pure	.285	493	7.90
Lead—Cast	**.410**	**709**	**11.35**
Lead—Rolled	**.412**	**712**	**11.40**
Magnesium	.063	109	1.75
Mercury	.491	849	13.60
Monel Metal	.320	552	8.85
Nickel	.318	549	8.80
Platinum	.777	1342	21.50
Silver	.379	656	10.50
Tin—Cast	**.264**	**456**	**7.30**
Tin—Rolled	**.271**	**468**	**7.50**
Tungsten	.683	1180	18.90
Zinc—Cast	.253	437	7.00
Zinc—Rolled	.260	449	7.20

PROPERTIES OF LEAD

Lead is a bluish gray metal with a bright lustre when melted or newly cut.

It is the heaviest of all common metals.

Reichs gives 11.37 as specific gravity for pure lead at zero centigrade. Roberts-Austen gives 11.40 for solid lead and 10.65 and 10.67 for liquid lead. Commercial lead has a lower specific gravity than 11.37 on account of the impurities contained in it.

Lead is soft and malleable, but is almost devoid of elasticity.

In the form of filings it becomes a solid mass if subjected to a pressure of 13 tons to the square inch, and liquefies at 2½ times this pressure (*Roberts-Austen*).

Lead undergoes no change in perfectly dry air, nor in water that is free from air.

Lead becomes pasty at about 617°F. and melts at about 625°F. (330°C.). (*Kent.*) It boils at about 1500°C., but cannot be distilled.

Atomic weight, 206.9

Coefficient of linear expansion by heat for 1°F. is 0.00001571

At 12°C., taking silver as 100, thermal conductivity is 8.5, and electrical is 10.7

Shrinkage of castings is 5-16 of an inch to one foot.

PROPERTIES OF TIN

Specific gravity of cast tin is 7.291, of rolled tin is 7.299, and of electrically deposited tin is from 7.143 to 7.178

Melting point about 446°F. or 230°C.

Coefficient of linear expansion by heat for 1° F, is 0.0000151

Atomic weight, 119.0

Conductivity of heat is 14.5 to 15.2, of electricity is 11.45, when silver is taken as 100

Breaking strength for cast tin is about 2½ tons per square inch.

PROPERTIES OF ANTIMONY

Specific gravity is 6.72 to 6.86

Melts at about 800F°.

Boiling point between 1090 and 1450°C.

Atomic weight, 120

Coefficient of linear expansion for 1°F. is .0000064

Conductivity of heat (silver being 100) along axis of crystalization is 21.5, and at right angles to this is 19.3

Conductivity of electricity at 18.7°C. (silver being 100) is 4.29

COMPOSITION ORGAN TUBING

THIS TUBING POSSESSES THE NECESSARY STIFFNESS WITHOUT BEING BRITTLE

13/32	in. inside diameter	x 1/2	in. outside diameter	— 5 7/8	oz. per foot.
3/8	" "	x 7/16	" "	— 3 1/4	" " "
17/64	" "	x 21/64	" "	— 2 3/8	" " "
5/16	" "	x 27/64	" "	— 4 1/2	" " "

OTHER SIZES MADE TO ORDER

TUBING

We make pure lead and pure tin tubing for any purpose.

LEAD CAMES

30 **28** **32**

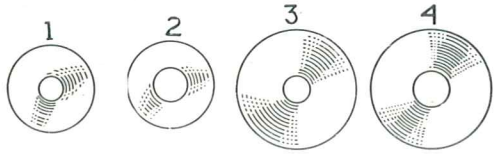
We manufacture an almost endless variety of lead cames for art glass work.

DRESS WEIGHTS

No. 1.	11/16	in outside diameter.		
No. 2.	13/16	"	"	"
No. 3.	1	"	"	"
No. 4.	1 1/8	"	"	"
No. 5.	1 1/4	"	"	"

All standard weight and uniform size. Packed 100 in a box.

ROOFING WASHERS



ACTUAL SIZE

No. 1 — 279 to the lb.
No. 2 — 296 " " "
No. 3 — 110 " " "
No. 4 — 112 " " "

SOUNDING LEADS

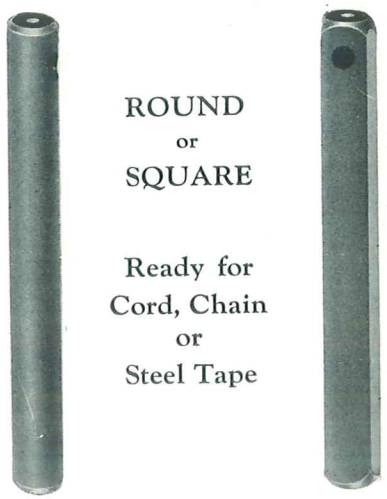
We can furnish any weight up to 50 lbs. for different depths.

COD LEADS

All sizes from 1 to 16 oz.

NET LEADS

WINDOW WEIGHTS



ROUND
or
SQUARE

Ready for
Cord, Chain
or
Steel Tape

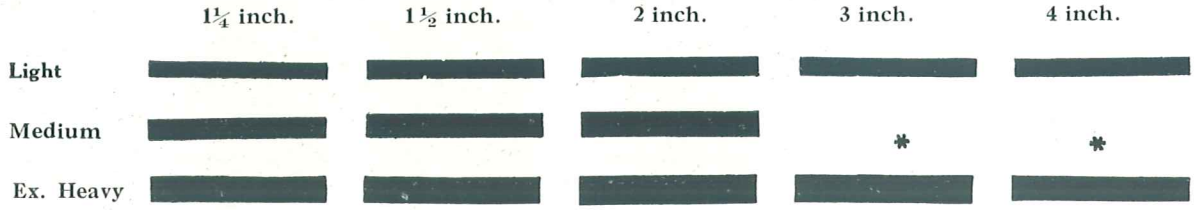
Guide for Ordering Window Weights

Weight of 1 foot in length of solid lead, round or square, from 1 inch to 4 inches, inclusive.

SQUARE INCHES	LBS.	ROUND INCHES	LBS.
1	4.93	1	3.87
1 1/8	6.24	1 1/8	4.90
1 1/4	7.70	1 1/4	6.05
1 3/8	9.32	1 3/8	7.32
1 1/2	11.09	1 1/2	8.71
1 5/8	13.01	1 5/8	10.22
1 3/4	15.09	1 3/4	11.85
1 7/8	17.32	1 7/8	13.61
2	19.71	2	15.48
2 1/8	22.25	2 1/8	17.48
2 1/4	24.95	2 1/4	19.59
2 3/8	27.80	2 3/8	21.83
2 1/2	30.79	2 1/2	24.18
2 5/8	33.96	2 5/8	26.67
2 3/4	37.26	2 3/4	29.27
2 7/8	40.73	2 7/8	32.00
3	44.34	3	34.83
3 1/4	52.07	3 1/4	40.52
3 1/2	60.82	3 1/2	47.26
3 3/4	69.33	3 3/4	54.00
4	78.88	4	61.93

DRAWN LEAD TRAPS AND BENDS

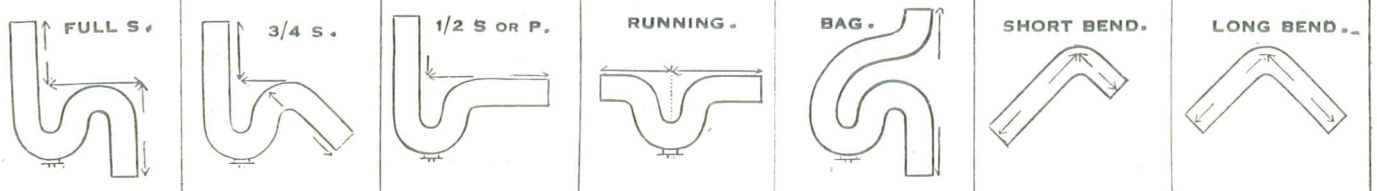
FULL WEIGHT



Exact thickness of Lead in Lead Traps and Bends as manufactured by us.

* No medium weights made in 3 and 4 inch sizes.

DIMENSION SCALE FOR REGULAR TRAPS AND BENDS



Size Inter. Diam.	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Length Over All	Center to Ends	Center to Ends
1¼ inches	4¼ inches	6¼	4¼ inches	5¼	4½ inches	6	4½ inches	5½	11½ inches	6 inches	3½ 6 inches
1½ inches	4½ inches	7	4½ inches	6	4½ inches	7	5¼ inches	6¼	13 inches	7 inches	4 7 inches
2 inches	4½ inches	8	4½ inches	7½	4½ inches	8	5¼ inches	7½	15 inches	7¾ inches	3¾ 7¾ inches
3 inches	4 inches	10½	4 inches	10	4 inches	9½	7½ inches	7½	18½ inches	8¼ inches	4¼ 8¼ inches
4 inches	3¼ inches	11½	3¼ inches	11	3¼ inches	10	8 inches	8	22½ inches	10 inches	5½ 10 inches

LIST PRICES OF REGULAR TRAPS AND BENDS

	LIGHT WEIGHT					MEDIUM WEIGHT			EXTRA-HEAVY WEIGHT					
Weight of Lead per Running Foot	**1½ lbs.**	**2¼ lbs.**	**3¼ lbs.**	**5 lbs.**	**6 lbs.**	**2 lbs.**	**3 lbs.**	**4 lbs.**	**2½ lbs.**	**3½ lbs.**	**4½ lbs.**	**6 lbs.**	**8 lbs.**	**10 lbs.**
	1¼ in.	**1½ in.**	**2 in.**	**3 in.**	**4 in.**	**1¼ in.**	**1½ in.**	**2 in.**	**1¼ in.**	**1½ in.**	**2 in.**	**3 in.**	**4 in.**	**4 in.**
Full S	$ .58	$ .90	$1.38	$2.69	$3.25	$ .73	$1.03	$1.65	$ .87	$1.25	$1.85	$3.09	$3.09	.....
¾ S	.55	.81	1.30	2.62	3.07	.66	.94	1.53	.81	1.15	1.73	2.97	3.95	.....
½ S, or P	.51	.75	1.20	2.24	2.49	.64	.87	1.42	.77	1.09	1.57	2.58	3.25	.....
Running	.48	.72	1.13	2.09	2.53	.58	.87	1.32	.70	1.03	1.46	2.35	3.28	.....
Bag	.68	1.08	1.73	3.35	4.77	.87	1.28	2.08	1.06	1.54	2.33	3.96	6.30	.....
Long Bend	.30	.50	.78	1.39	1.95	.41	.66	1.00	.50	.79	1.05	1.60	2.40	$3.00
Short Bend	.25	.38	.57	1.09	1.50	.31	.51	.69	.34	.62	.80	1.21	1.84	2.30

In ordering be careful to state WEIGHT desired

DRAWN LEAD TRAPS AND BENDS

FULL WEIGHT

DIMENSION SCALE FOR EXTRA LONG TRAPS

SIZE, INTERNAL DIAM. Measurements taken as shown by Arrows on cuts of Regular Traps	FULL S.	¾ S.		½ S. OR P.		RUNNING		BAG
	LENGTH OVER ALL	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	LENGTH OVER ALL
1¼ inches	24 inches	4¼ inches	16¼	4¼ inches	14¼	4½ inches	17½	24 inches
1½ inches	24 inches	4½ inches	15¾	4½ inches	14	5¼ inches	16¾	24 inches
2 inches	24 inches	4¼ inches	15½	4½ inches	14	5¼ inches	16¾	24 inches

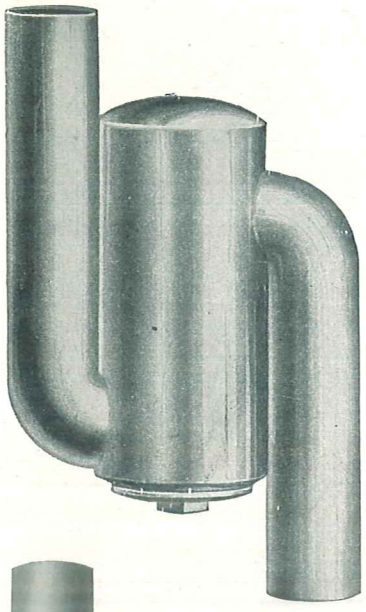
LIST PRICES OF EXTRA LONG TRAPS AND BENDS

	LIGHT WEIGHT			MEDIUM WEIGHT			EXTRA-HEAVY WEIGHT		
Weight of Lead per Running Foot	1½ lbs.	2¼ lbs.	3¼ lbs.	2 lbs.	3 lbs.	4 lbs.	2½ lbs.	3½ lbs.	4½ lbs.
	1¼ in.	1½ in.	2 in.	1¼ in.	1½ in.	2 in.	1¼ in.	1½ in.	2 in.
Full S.	$ .93	$1.36	$2.00	$1.19	$1.64	$2.40	$1.44	$1.95	$2.69
¾ S.	.85	1.19	1.76	1.04	1.43	2.08	1.28	1.72	2.33
½ S.	.76	1.02	1.55	.95	1.22	1.83	1.14	1.50	2.02
Running	.82	1.15	1.67	1.01	1.41	1.98	1.23	1.65	2.18
Bag	1.09	1.58	2.34	1.38	1.91	2.80	1.67	2.24	3.11

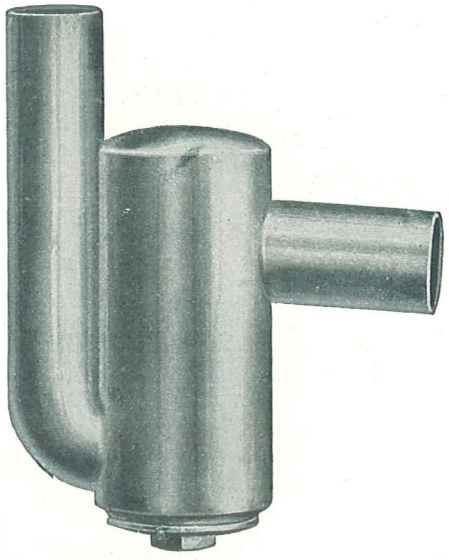
EXTENSION BENDS

Weight of Lead per Running Foot	1½ lbs.	2¼ lbs.	3¼ lbs.	5 lbs.	6 lbs.	2 lbs.	3 lbs.	4 lbs.	2½ lbs.	3½ lbs.	4½ lbs.	6 lbs.	8 lbs.	10 lbs.
	1¼ in.	1½ in.	2 in.	3 in.	4 in.	1¼ in.	1½ in.	2 in.	1¼ in.	1½ in.	2 in.	3 in.	4 in.	4 in.
Short-inlet end x 12 inches	$ .40	$ .56	$ .79	$1.39	$1.70	$ .52	$ .75	$ .99	$ .60	$ .90	$1.08	$1.57	$2.09	$2 62
" " " x 15 "	.47	.67	.94	1.65	2.00	.62	.89	1.17	.72	1.07	1.28	1.87	2.45	3.07
" " " x 18 "	.55	.77	1.09	1.90	2.30	.72	1.03	1.36	.84	1.24	1.49	2.16	2.81	3.51
" " " x 20 "	.60	.84	1.19	2.07	2.48	.79	1.12	1.49	.92	1.35	1.63	2.35	3.04	3.80
Long-inlet end x 12 "	.46	.67	.99	1.73	2.15	.60	.89	1.24	.70	1.07	1.35	1.96	2.62	3.28
" " " x 15 "	.54	.77	1.14	1.99	2.44	.70	1.03	1.42	.82	1.24	1.56	2.25	2.98	3.73
" " " x 18 "	.62	.88	1.29	2.24	2.73	.80	1.17	1.61	.92	1.41	1.76	2.54	3.34	4.18
" " " x 20 "	.67	.95	1.39	2.42	2.92	.87	1.26	1.74	1.02	1.52	1.90	2.74	3.58	4.48
For extension bends longer than above add to nearest listed size for each additional inch	.03¼	.04½	.06¼	.10¾	.12	.04¼	.06	.07¾	.05	.07	.08½	.12	.15	.20

In ordering be careful to state WEIGHT desired



CAST LEAD
CLEAN SWEEP TRAPS



LIST PRICES

	FULL S	HALF S
1¼ in.	$1.20	$1.10
1½ in.	1.55	1.35

DRAWN LEAD
SAFE SEAL TRAPS

LIST PRICES

	FULL S	HALF S
1¼ in.	$1.50	$1.35
1½ in.	1.85	1.65
Heavy		
1¼ in.	$1.65	$1.50
1½ in.	2.00	1.80

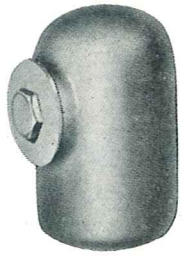
ROUND or
DRUM TRAPS

Top Screw

SIZES (BOTH PATTERNS)

4 x 8 in. — 5 lbs.	5 x 9 in. — 8 lbs.
4 x 9 " — 5 "	5 x 9 " — 9 "
4 x 8 " — 6 "	6 x 10 " — 10 "
4 x 9 " — 6 "	6 x 10 " — 12 "
4 x 8 " — 8 "	Other sizes to order.
4 x 9 " — 8 "	

These cuts show the ordinary cover.
Nickel-plated wide flange covers furnished to order.



Side Screw

"Athol" Soil Pipe Union Ferrule

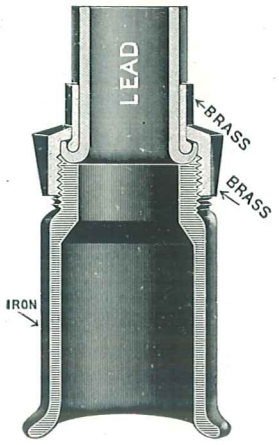


Figure 33

Figure 33A

A soil pipe union ferrule for connecting 2 in. soil pipe with 1¼ in. or 1½ in. lead pipe without the use of solder.

The method is very simple as shown in the illustration. The turned-over end of the lead pipe forms the packing.

Serves as a cleanout and can be disconnected at any time. No special tools required.

Made in two sizes.

FIGURE 33	FIGURE 33A, EIGHTH BEND
2″ x 1¼″ Iron Body with Brass Union	2″ x 1¼″ Iron Body with Brass Union
2″ x 1¼″ All Brass	2″ x 1¼″ All Brass
2″ x 1½″ Iron Body with Brass Union	2″ x 1½″ Iron Body with Brass Union
2″ x 1½″ All Brass	2″ x 1½″ All Brass

"RAYMOND" COMBINATION (Lead and Iron) FERRULES

UNITED STATES STANDARD PRICE LIST

STANDARD WEIGHT Cast-Iron Pipe	LENGTHS—(In Inches) 4	4½	5	6	8	10	12	14	16	18	20
1¼ in. for 2-in.	.....	$0.28	$0.36	$0.43	$0.51	$0.60	$0.67	.....	.....	.. ..	.....
1½ " " 2-"	.....	.28	.36	.43	.51	.60	.67	$0.80	$0.90	$1.00	$1.10
2 " " 2-"	$0.28	.....	.41	.46	.57	.67	.76	.80	.86	.92	1.00
3 " " 3-"	.42	.....	.60	.67	.82	.98	1.10	1.15	1.22	1.30	1.40
4 " " 4-"	.50	.....	.72	.85	1.02	1.25	1.40	1.60	1.73	1.85	2.10
EXTRA HEAVY WEIGHT Cast-Iron Pipe											
1½ in. for 2-in.	.....	$0.38	$0.44	$0.52	$0.61	$0.72	$0.80	$1.15	$1.30	$1.45	$1.60
2 " " 2-"	$0.42	.. ..	.49	.54	.67	81	.93	1.10	1.23	1.36	1.49
3 " " 3-"	.55	.....	.75	.84	1.00	1.18	1.35	1.46	1.63	1.80	1.97
4 " " 4-"	.70	.....	84	.94	1.23	1.45	1.67	2.00	2.21	2.45	2.70

No. 5

Hub Pattern Brass Ferrule

No. O-B 3″ x 4½″ long, extra heavy
No. 3 4″ x 4″ long, standard
No. 5A 4″ x 4½″ long, extra heavy
No. 4 4″ x 5″ long, stand. (approx. 28 oz.)
No. 5 4″ x 5″ long, ex. hvy. (approx. 32 oz.)
No. 5B 4″ x 5″ long, ex. hvy. (approx. 36 oz.)
No. 5C 4″ x 5″ long, ex. hvy. (approx. 40 oz.)

No. 8

Taper Pattern Brass Ferrule

No. 7 2″ x 1½″, 3¾″ long, standard
No. O-8 2″ x 1½″, 4″ long, extra heavy
No. 8 2″ x 2″, 4″ long, ex. hvy. (approx. 14 oz.)
No. 8A 2″ x 2″, 4″ long, ex. hvy. (approx. 16 oz.)
No. 8B 2″ x 2″, 8″ long, extra heavy

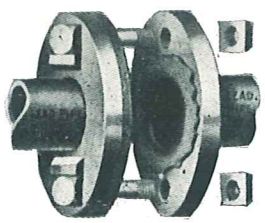
Note—The numbers 7 and O-8 are 1½ in. inside diameter on taper end. The 8, and 8A are 1$^{13}/_{16}$ in. inside diameter on taper end. The 8B is 1$^{15}/_{16}$ in. inside diameter on taper end.

No. O-A 3″ x 4½″ long, extra heavy.
(Taper end 3 in. inside diameter; 3¼ in. outside diameter.)

No. 2A 4″ x 4½″ long, extra heavy
No. 2 4″ x 5″ long, extra heavy

Brass Water Gauges

For regulating flow of water in aqueduct and spring water pipes; will fit ⅜ in., ½ in. and ⅝ in. Lead Pipe.



Lead Pipe Flange Couplings

Sizes, ⅜, ½, ⅝, ¾, 1, 1¼, 1½, 2 inch

Consisting of two iron flanges with leather gasket between, held together with two brass bolts and brass nuts for connecting lead pipe. The ends of pipe are first spread with turnpin.

BARNES AND ATHOL PUMPS

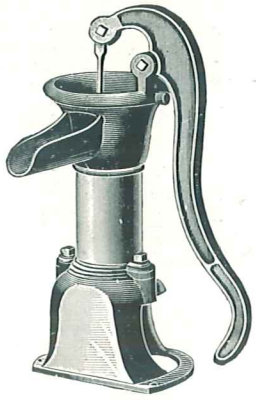


Fig. 150

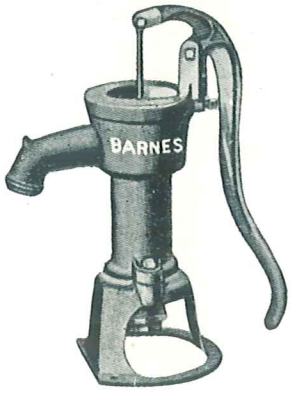


Fig. 108

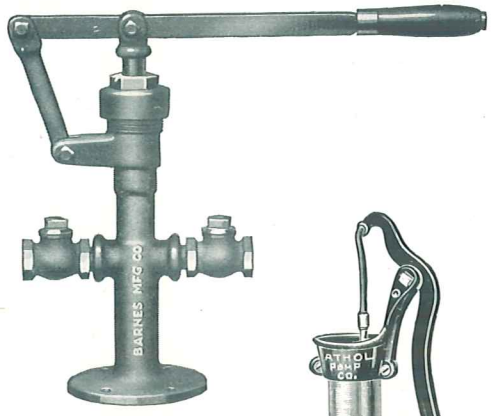


Fig. 242

Fig. 840

Fig. 604

Fig. 256

Fig. 275

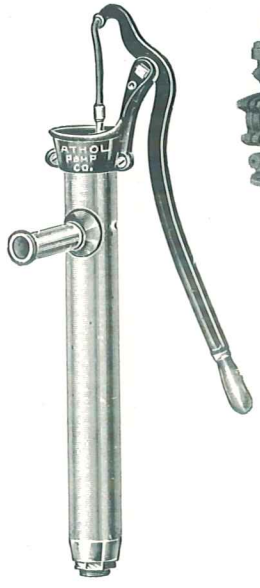


Fig. 57

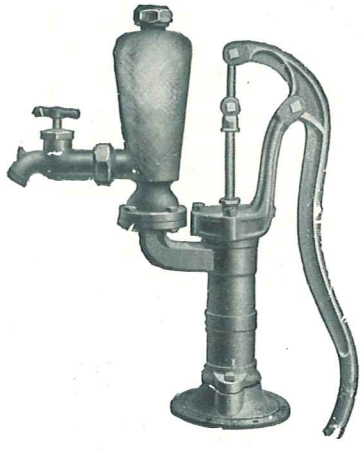


Fig. 218

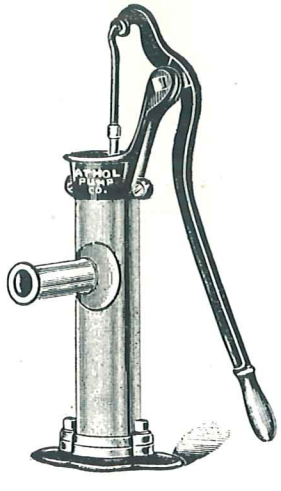


Fig. 20 Nickel Plated

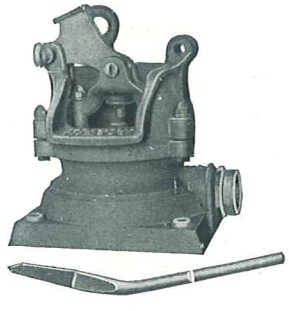


Fig. 381

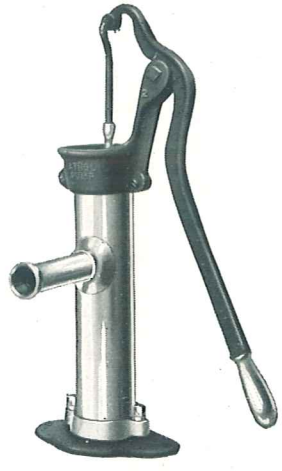


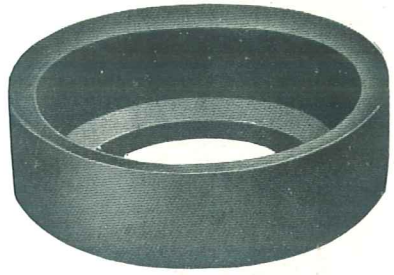
Fig. 20 Copper

We Carry a Complete Stock of Repairs to Iron and Copper Pumps

LEATHER WASHERS

FLAT PLUNGER LEATHER

LOWER VALVE LEATHER



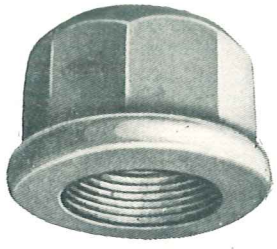
CUP LEATHER

Carried in stock for all sizes Pitcher and Cistern Pumps.

Other sizes made to order.
Stock sizes ¾″ to 6″

DRIVE WELL POINTS

WASHER OR BRASS JACKET



LIST PRICES

Diam.	24 in.	30 in.	36 in.	42 in.	48 in.
1¼ in.	$3.00	$3.84	$4.67	$5.50	$6.34
1½ "	4.00	5.00	6.00	7.00	8.00
2 "	6.25	7.50	8.75	10.00	11.25

TABLE—for Finding the Velocity in Inches per Second, and the Discharge in Cubic Feet per Minute, from a Cylindrical Pipe, when the Diameter and Fall are given.

Any two of the four quantities—the Velocity, Discharge, Diameter, and Fall—being given, the others can be found in the table by inspection. Interpolate for intermediate diameters. For greater diameters, divide by 4, and multiply the corresponding discharge by 32; or, divide the greater discharges by 32, and multiply the corresponding diameter by 4. Divide the fall into the length of the pipe for the inclination; for a long supply pipe, with large well-rounded bends and curves, this will agree with the mean hydraulic inclination, no matter how the intermediate inclinations may vary. For a short pipe, the approximate velocity must be first found as for a long one, then deduct the head due to this velocity (found in the Auxiliary Table) from the given head; the difference will be the head due to friction nearly: for very short pipe, repeat this operation once more. The head due to friction, divided into the length of the pipe, gives the mean hydraulic inclination. For a 6-inch pipe, the velocity in inches per second is equal, practically, to the discharge in cubic feet per minute. In practice, the diameter of a pipe calculated to supply a given discharge should be increased by one-sixth, to meet different losses of head, apart from that of friction. (*Vide* Neville's Hydraulic Tables and Formulæ, pp. 103–127.)

Fall per mile due to friction, in feet.	Mean hydraulic inclination.	The Velocity in Inches per Second is given in the First Horizontal Line, the Discharge in Cubic Feet per Minute in the next.																			Mean hydraulic inclination.	Fall per mile due to friction, in feet.
		1-in. diam.	2-in. diam.	3-in. diam.	4-in. diam.	5-in. diam.	6-in. diam.	7-in. diam.	8-in. diam.	9-in. diam.	10-in. diam.	12-in. diam.	14-in. diam.	16-in. diam.	18-in. diam.	20-in. diam.	22-in. diam.	24-in. diam.	26-in. diam.	28-in. diam.	30-in. diam.		
1	**5280**	1.7	2.5	3.2	3.8	4.2	4.7	5.1	5.5	5.9	6.2	6.8	7.4	8.0	8.5	8.9	9.4	9.8	10.3	10.7	11.1	**5280**	**1**
"	"	.05	.27	.79	1.6	2.9	4.6	6.8	9.6	12.9	16.9	26.9	40	56	75	98	124	155	189	228	271	"	"
2	**2640**	2.5	3.8	4.7	5.6	6.3	6.9	7.5	8.1	8.6	9.1	10.1	10.9	11.7	12.5	13.2	13.9	14.5	15.1	15.7	16.3	**2640**	**2**
"	"	.07	.41	1.2	2.4	4.3	6.8	10.1	14.2	19.1	24.9	40	58	82	110	144	183	228	278	336.6	400	"	"
3	**1760**	3.1	4.7	5.9	7.0	7.8	8.7	9.4	10.2	10.8	11.5	13	14	15	16	17	17	18	19	20	20	**1760**	**3**
"	"	.08	.51	1.4	3.0	5.3	8.5	12.6	17.7	23.9	31.2	50	73	103	138	180	229	285	349	421	500	"	"
4	**1320**	3.6	5.5	6.9	8.2	9.2	10.2	11.1	11.9	12.7	13.4	15	16	17	18	19	20	21	22	23	24	**1320**	**4**
"	"	.10	.6	1.7	3.6	6.3	10.0	14.8	20.8	28.0	36.7	58	86	120	163	212	269	335	410	494	588	"	"
5	**1056**	4.1	6.2	7.9	9.3	10.4	11.6	12.5	13.5	14.4	15.2	17	18	20	21	22	23	24	25	26	27	**1056**	**5**
"	"	.11	.68	1.9	4.0	7.1	11.3	16.8	23.6	31.7	41.5	66	97	136	184	240	305	380	464	560	665	"	"
6	**880**	4.6	6.9	8.7	10.3	11.5	12.8	13.9	15.0	15.9	16.9	19	20	22	23	24	26	27	28	29	30	**880**	**6**
"	"	.12	.76	2.2	4.5	7.9	12.6	18.6	26.1	35.1	46.0	73	108	151	202	265	337	420	514	620	737	"	"
7	**754**	5.0	7.5	9.5	11.2	12.6	14.0	15.1	16.3	17.4	18.4	20	22	24	25	27	28	29	30	32	33	**754**	**7**
"	"	.14	.82	2.3	4.9	8.6	13.7	20.2	28.5	38.3	50.2	80	118	165	222	289	368	458	560	676	804	"	"
8	**660**	5.4	8.1	10.2	12.0	13.5	15.0	16.3	17.6	18.7	20.0	22	24	25	27	29	30	31	33	34	35	**660**	**8**
"	"	.15	.89	2.5	5.3	9.2	14.8	21.8	30.6	41.3	54.1	86	127	177	239	312	397	493	604	728	866	"	"
9	**587**	5.7	8.7	11.0	12.9	14.5	16.1	17.4	18.8	20.0	21.2	23	25	28	29	30	32	33	35	36	38	**587**	**9**
"	"	.16	.95	2.7	5.6	9.9	15.8	23.3	32.8	44.1	57.7	92	135	192	255	333	424	527	645	778	925	"	"
10	**528**	6.1	9.2	11.6	13.7	15.4	17.1	18.5	19.9	21.2	22.5	25	27	29	31	32	34	36	37	39	40	**528**	**10**
"	"	.17	1.0	2.9	6.0	9.2	16.7	24.7	34.8	46.8	61.3	97	144	201	271	354	450	560	685	826	982	"	"
11	**480**	6.4	9.7	12.3	14.4	16.2	18.0	19.5	21.0	22.4	23.7	26	28	30	32	34	36	38	39	41	42	**480**	**11**
"	"	.17	1.1	3.0	6.3	11.1	17.7	26.1	36.7	49.4	64.7	103	152	213	286	373	475	590	723	871	1036	"	"
12	**440**	6.7	10.2	12.9	15.2	17.1	18.9	20.5	22.1	23.5	24.9	27	30	32	34	36	38	39	41	43	44	**440**	**12**
"	"	.18	1.1	3.2	6.6	11.6	18.6	27.4	38.6	51.9	67.9	108	159	223	300	392	498	620	759	916	1089	"	"
13.2	**400**	7.1	10.8	13.6	16.0	18.0	20.0	21.7	23.3	24.8	26.3	29	31	34	36	38	40	42	43	45	47	**400**	**13.2**
"	"	.19	1.2	3.3	6.9	12.3	19.6	28.9	40.7	54.8	71.7	114	168	236	317	414	526	655	801	966	1149	"	"
14.1	**375**	7.4	11.2	14.1	16.6	18.7	20.7	22.5	24.2	25.7	27.3	30	33	35	37	39	41	43	45	47	49	**375**	**14.1**
"	"	.20	1.2	3.5	7.2	12.7	20.3	30.0	42.3	56.9	74.4	118	174	244	329	429	546	680	831	1003	1192	"	"
15.1	**350**	7.7	11.6	14.7	17.2	19.4	21.6	23.4	25.2	26.8	28.4	31	34	36	39	41	43	45	47	49	50	**350**	**15.1**
"	"	.21	1.3	3.6	7.5	13.2	21.2	31.2	43.9	59.1	77.4	123	181	254	342	446	568	707	865	1043	1240	"	"
16.2	**325**	8.0	12.1	15.3	18.0	20.2	22.5	24.4	26.3	27.9	29.6	33	35	38	40	43	45	47	49	51	53	**325**	**16.2**

"	"	.22	1.3	3.7	7.8	13.8	22.1	32.6	45.9	61.7	80.7	128.0	189.0	265.0	357.0	466.0	592.0	738.0	902.0	1088.0	1294.0	"	"
17.6	**300**	8.4	12.7	16.0	18.8	21.2	23.5	25.5	27.5	29.2	31.0	34	37	40	42	45	47	49	51	53	55	**300**	**17.6**
"	"	.23	1.4	3.9	8.2	14.4	23.1	34.1	40.8	64.6	84.5	134	198	278	374	487	620	772	944	1139	1354	"	"
19.2	**275**	8.8	13.4	16.8	19.8	22.3	24.7	26.8	28.9	30.7	32.6	36	39	42	44	47	49	52	54	56	58	**275**	**19.2**
"	"	.25	1.5	4.1	8.6	15.2	24.3	35.8	50.4	67.9	88.8	141	208	292	393	512	652	812	993	1197	1424	"	"
21.1	**250**	9.4	14.1	17.8	20.9	23.5	26.1	28.3	30.5	32.5	34.4	38	41	44	47	50	52	55	57	59	61	**250**	**21.1**
"	"	.26	1.5	4.4	9.2	16.0	25.7	37.8	53.3	71.7	93.8	149	219	308	415	541	688	857	1048	1264	1504	"	"
23.5	**225**	9.9	15.0	18.9	22.2	25.0	27.8	30.1	32.4	34.5	36.6	40	44	47	50	53	55	58	61	63	65	**225**	**23.5**
"	"	.27	1.6	4.7	9.7	17.0	27.3	40.2	56.6	76.2	99.7	158	233	327	441	575	731	911	1114	1344	1599	"	"
26.4	**200**	10.6	16.0	20.2	23.8	26.8	29.7	32.2	34.7	36.9	39.1	43	47	50	53	56	59	62	65	67	70	**200**	**26.4**
"	"	.29	1.7	5.0	10.4	18.2	29.2	43.1	60.6	81.6	106.7	169	249	350	472	616	783	975	1192	1438	1710	"	"
30.2	**175**	11.4	17.3	21.9	25.7	28.9	32.1	34.8	37.5	39.9	42.3	46	50	54	58	61	64	67	70	73	75	**175**	**30.2**
"	"	.31	1.9	5.4	11.2	19.7	31.5	46.5	65.5	88.1	115.3	183	269	379	510	665	846	1053	1289	1555	1850	"	"
35.2	**150**	12.5	19.0	23.9	28.1	31.6	35.1	38.1	41.0	43.7	46.3	51	55	59	63	67	70	73	76	79	82	**150**	**35.2**
"	"	.34	2.1	5.9	12.3	21.6	34.5	50.9	71.6	96.4	126.2	200	294	414	558	728	925	1152	1409	1700	2021	"	"
37.7	**140**	13.0	19.7	24.9	29.3	32.9	36.6	39.7	42.7	45.5	48.2	53	57	62	66	69	73	76	80	83	86	**140**	**37.7**
"	"	.35	2.2	6.1	12.8	22.4	35.9	53.0	74.6	100.4	131.3	208	307	431	581	758	963	1200	1469	1773	2110	"	"
42.2	**125**	13.9	21.1	26.6	31.3	35.2	39.1	42.4	45.7	48.6	51.5	57	61	66	70	74	78	82	85	88	92	**125**	**42.2**
"	"	.38	2.3	6.5	13.6	24.0	38.4	56.6	79.7	107.3	140.3	223	328	461	621	810	1030	1282	1569	1894	2254	"	"
48	**110**	15.0	22.7	28.7	33.7	37.9	42.1	45.7	49.2	52.4	55.5	61	66	71	76	80	84	88	92	95	99	**110**	**48**
"	"	.41	2.5	7.0	14.7	25.9	41.4	61.0	85.9	115.7	151.3	240	354	497	669	873	1110	1382	1690	2039	2425	"	"
52.8	**100**	15.9	24.1	30.4	35.7	40.1	44.6	48.3	52.1	55.4	58.7	65	70	75	80	85	89	93	97	101	105	**100**	**52.8**
"	"	.43	2.6	7.4	15.6	27.3	43.8	64.6	90.9	122.3	160.1	254	374	526	708	923	1174	1462	1788	2157	2565	"	"
58.7	**90**	16.9	25.6	32.3	38.0	42.7	47.4	51.4	55.4	58.9	62.5	69	74	80	85	90	95	99				**90**	**58.7**
"	"	.46	2.8	7.9	16.6	29.1	46.6	68.7	96.7	130.2	170.3	270	398	559	753	982	1250	1556				"	"
66	**80**	18.1	27.5	34.6	40.7	45.8	50.9	55.2	59.4	63.2	67.0	74	80	86	91	96	101	106				**80**	**66**
"	"	.49	3.0	8.5	17.8	31.2	49.9	73.7	103.7	139.6	182.7	290	427	600	808	1054	1340	1669				"	"
75.4	**70**	19.6	30.0	37.5	44.1	49.6	55.1	59.7	64.4	68.4	72.5	80	86	93	99	105	110	115				**70**	**75.4**
"	"	.53	3.2	9.2	19.2	33.8	54.1	79.8	112.3	151.2	197.7	314	463	650	875	1141	1451	1807				"	"
88	**60**	21.5	32.6	41.1	48.3	54.4	60.4	65.5	70.6	75.1	79.5	88	95	102	109	115	120	126				**60**	**88**
"	"	.59	3.6	10.1	21.1	37.1	59.3	87.5	123.2	165.8	216.9	344	506	712	959	1251	1591	1981				"	"
105.6	**50**	24.0	36.4	45.8	53.9	60.7	67.4	73.1	78.7	83.7	88.7	98	106	114	121	128	134	141				**50**	**105.6**
"	"	.65	4.0	11.2	23.5	41.3	66.2	97.6	137.4	184.9	242.0	384	565	795	1070	1396	1775	2211				"	"
117.3	**45**	25.5	38.8	48.9	57.4	64.6	71.8	77.8	83.9	89.2	94.5	104	113	121	129	136	143	150				**45**	**117.3**
"	"	.70	4.2	12.0	25.1	44.1	70.5	104.0	146.4	197.1	257.8	409	602	846	1140	1487	1891	2356				"	"
132	**40**	27.4	41.6	52.5	61.7	69.4	77.1	83.6	90.1	95.8	101.5	119	124	130	138	146	153	161				**40**	**132**
"	"	.75	4.5	12.8	26.9	47.3	75.7	111.7	157.2	211.6	276.8	467	665	908	1224	1597	2031	2529				"	"
150.8	**35**	29.7	45.1	56.9	66.9	75.2	83.6	90.6	97.6	103.8	110.0	121	131	141	150	159	167	174				**35**	**150.8**
"	"	.81	4.9	13.9	29.2	51.3	82.0	121.1	170.4	229.4	300.1	476	697	985	1327	1731	2201	2741				"	"
176	**30**	32.6	49.5	62.5	73.4	82.6	91.7	99.5	107.2	114.0	120.8	133	144	155	165	174	183	192				**30**	**176**
"	"	.89	5.4	15.3	32.0	56.3	90.0	132.9	187.1	251.8	329.4	523	770	1082	1456	1900	2417	3010				"	"
212.2	**25**	36.4	55.3	69.8	82.0	92.2	102.4	111.1	119.7	127.3	134.9	149	161	173	184	195	204	214				**25**	**212.2**
"	"	.99	6.0	17.1	35.8	62.9	100.6	148.4	208.9	281.2	367.9	584	860	1208	1627	2122	2699	3362				"	"
264.1	**20**	41.7	63.3	79.9	93.8	105.6	117.3	127.2	137.0	145.7	154.4	170	184	198	211	223	234	245				**20**	**264**
"	"	1.14	6.9	19.6	40.9	72.0	115.1	169.9	239.2	321.9	421.2	668	984	1383	1862	2430	3090	3848				"	"
352	**15**	49.6	75.3	95.0	111.7	125.6	139.6	151.3	163.1	173.4	183.8	202	219	236	251	265	278	292				**15**	**352**
"	"	1.35	8.2	23.3	48.3	85.6	137.0	202.2	284.6	383.1	501.2	795	1171	1646	2216	2891	3677	4579				"	"
528	**10**	63.3	96.0	121.2	142.4	160.2	178.0	192.9	207.9	221.1	234.3	258	279	301	320	338	355	372				**10**	**528**
"	"	1.73	10.5	29.7	62.1	109.2	174.7	257.8	362.9	488.5	639.0	1014	1496	2098	2826	3686	4688	5839				"	"

Auxiliary Table of Velocities due to Heads for Different Junctions.

Heads due to the Velocity in the Pipe, and Junctions.	Best Curved Junction.	Square Junction.	Pipe Projecting into Cistern.
0.1	27.8	22.7	20.0
0.2	39	32	28
0.3	48	39	34
0.4	56	45	40
0.6	68	56	49
0.8	79	64	56
0.10	88	72	63
1.0	96	78	69
2	136	111	97
3	167	136	119
4	193	157	138
5	215	176	154
6	236	192	169
7	255	208	182
8	272	222	194
9	289	235	207
10	305	248	218
12	334	272	239
14	360	294	257
16	385	314	275
18	409	333	292
20	431	351	307

WEIGHTS AND MEASURES

AVOIRDUPOIS WEIGHT

437½ grains	=	1 ounce
16 ounces	=	1 pound
25 pounds	=	1 quarter
4 quarters	=	1 cwt.
20 cwt.	=	1 ton
2240 pounds	=	1 long ton

APOTHECARIES' WEIGHT

20 grains	=	1 scruple
3 scruples	=	1 dram
8 drams	=	1 ounce
12 ounces	=	1 pound

TROY WEIGHT

24 grains	=	1 pennyweight
20 pwt.	=	1 ounce
12 ounces	=	1 pound

DRY MEASURE

2 pints	=	1 quart
8 quarts	=	1 peck
4 pecks	=	1 bushel
36 bushels	=	1 chaldron

LIQUID MEASURE

4 gills	=	1 pint
2 pints	=	1 quart
4 quarts	=	1 gallon
31½ gallons	=	1 barrel
2 barrels	=	1 hogshead

LINEAR MEASURE

12 inches	=	1 foot
3 feet	=	1 yard
5½ yards	= 16½ feet =	1 rod
320 rods	= 5280 feet =	1 statute mile
6080.20 feet	=	1 nautical mile

SURFACE MEASURE

144 sq. inches	=	1 sq. foot
9 sq. feet	=	1 sq. yard
30¼ sq. yards	=	1 sq. rod
160 sq. rods	=	1 acre
640 acres	=	1 sq. mile
1 acre	=	43,560 sq. ft.

CUBIC OR SOLID MEASURE

1728 cu. inches	=	1 cu. foot
27 cu. feet	=	1 cu. yard
128 cu. feet	=	1 cord
40 cu. feet	=	1 ton of ship cargo

METRIC WEIGHTS AND MEASURES

Metric weights and measures form a decimal system based upon the meter.

For convenience, the litre is used as the unit of capacity, and the gram as the unit of weight.

The litre equals one cubic decimeter.

The gram is the weight of one cubic centimeter of water at its greatest density.

Parts and multiples of the unit are indicated by the following prefixes.

Milli	(m)	meaning	1/1000
Centi	(c)	"	1/100
Deci	(d)	"	1/10
Deka	(D)	"	10
Hecto	(H)	"	100
Kilo	(K)	"	1,000
Myria	(M)	"	10,000

VOLUMES

Cone or pyramid = Area of base × ⅓ altitude.

Sphere = cube of diameter × .5236

AREAS

Circle = square of diameter × .7854

Sector of a circle = length of arc × half the radius.

Segment of a circle = area of sector of equal arc, diminished when segment is less than a semicircle, increased when segment is greater than a semicircle, by the area of the triangle formed by two radii of the circle and the chord of the segment.

Triangle = ½ base × altitude.

Parallelogram = base × altitude.

Trapezium = sum of areas of its two triangles.

Trapezoid = ½ sum of parallel sides × altitude.

Regular polygon = ½ perimeter × perpendicular from center to a side.

Ellipse = long diameter × short diameter × .7854

Surface of sphere = square of diameter × 3.1416

COMPARISONS

U. S. bushel	=	2150.42 cu. inches
Br. Im. bushel	=	2218.2 cu. inches
U. S. gallon	=	231 cu. inches
6 U. S. gallons	=	5 Br. Imp. gallons
1 cord	=	about 103 bushels
1 metre	= 39.37 in.	(U. S. Statute)
1 litre	= 61.022 cu. in.	" "
1 gram	= 15.42 grains	" "
25.4 m.m.	=	1 inch
30.48 c.m.	=	1 foot
1 metre	=	3.281 feet
1.6093 kilometre	=	1 mile
6.4515 sq. c.m.	=	1 sq. inch
1 sq. metre	=	10.764 sq. ft.
1 sq. metre	=	1,550 sq. inch
1 cu. metre	=	264.2 U. S. gallons
1 kilogram	=	2.2046 pounds
1,000 kilograms	=	1 metric ton
1 kg. per sq. cm.	=	14.223 lbs. per sq. inch

Quantity of Water Delivered by the Hydraulic Ram. — From 80 to 100 feet conveyance, one-seventh of supply from spring can be discharged at an elevation five times as high as the fall to supply the Ram; or, one-fourteenth can be raised and discharged, say ten times as high as the fall applied.

By a Ram under a head of 5 feet of every 7 gallons drawn from the spring, 1 gallon may be raised 25 feet, or ½ gallon 50 feet; or, with 10 feet fall of every 14 gallons from the spring, 1 gallon may be raised to 100 feet above the Ram; and so on, as rise and fall is increased or diminished.

Water can be conveyed by a Ram 3000 feet, and elevated 200 feet.

Rules for Dimensions of Pipes (Supply and Discharge). — The following table gives the capacity of the several sizes of our Rams, and the dimensions of the pipes to be used in connection with the same, and the size of the spring or brook to which they are adapted: —

Size of Ram.	Quantity of Water Furnished Per Minute, by the Spring or Brook to which the Ram is Adapted.	Length of Pipes.		Calibre of Pipes.		Weight of Pipe (Lead), or if Wrought Iron, then of Ordinary Weight.		
		Drive.	Discharge.	Drive.	Discharge.	Drive Pipe for head or fall not over 10 feet.	Discharge Pipe for not over 50 feet rise.	Discharge Pipe for over 50 feet and not exceeding 100 feet in height.
				inch.	inch.	per foot.	per foot.	per foot.
No. 2	3 qts. to 2 gals. per min.	25 to 50 ft.	To where desired.	¾	⅜	2 lbs.	10 ozs.	1 lb.
No. 3	1½ gal. to 4 " "	25 to 50 ft.		1	½	3 lbs.	12 ozs.	1 lb. 4 ozs.
No. 4	3 " to 7 " "	25 to 50 ft.		1¼	½	5 lbs.	12 ozs.	1 lb. 4 ozs.
No. 5	6 " to 14 " "	25 to 50 ft.		2	¾	8 lbs.	1 lb. 4 ozs.	2 lbs.
No. 6	12 " to 25 " "	25 to 50 ft.		2½	1	13 lbs.	2 lbs.	3 lbs.
No. 7	20 " to 40 " "	25 to 50 ft.		2½	1¼	13 lbs.	3 lbs.	4 lbs.
No. 10	25 " to 75 " "	25 to 50 ft.		4	2	21 lbs.	7 lbs.	8 lbs.

A cubic foot of Lead . . . . . Weighs 711 lbs.
A cubic inch of Lead . . . . . " 6 7/12 ozs.
A cubic foot of Cast Tin . . . " 459 lbs.
A cubic inch of Cast Tin . . . " 4¼ ozs.

Flow of Water through Orifices.

Rule. — To find quantity discharged per minute, multiply area of the orifice in square feet by the square root of the height of the level of the water above the orifice in feet, and the product multiplied by 297.6 will equal discharge in cubic feet, nearly.

Water at the average temperature of 60° F. weighs about 62.3 lbs. per cubic foot, and 8.3 lbs. per gallon.

A column of water 12 inches high exerts a downward pressure of about 0.434 of a pound to the square inch. This pressure per square inch is due to head (height that the water rises above orifice), irrespective of volume or anything else, except vertical height of column.

To find the pressure in pounds per square inch by a column of water, multiply the height of the column in feet by 0.434.

To find the head, multiply the pressure in pounds per square inch by 2.31.

To find the quantity of water flowing through a pipe of any length and diameter. (*Winslow.*)

Rule. — Multiply the velocity in feet per second by the area of the discharging orifice in feet, and the product is the quantity in cubic feet discharged per second.

Example. — The velocity is 2 feet per second, and the diameter of the pipe 5 inches; what quantity of water is discharged per second?

$$5 \div 12 = 0.4166,$$

and $0.4166^2 \times 0.7854 \times 2 = 0.273$ cubic feet.

To find diameter of pipes to discharge given quantity of water per minute in cubic feet.

Rule. — Multiply the square of the quantity in cubic feet per minute by 0.96, and the product equals the diameter of the pipe in inches.

To find the head necessary to produce a required velocity through a pipe of given length and diameter. (*Winslow.*)

Rule. — Multiply the square of the required velocity, in feet per second, by the length of the pipe multiplied by the quotient obtained by dividing 13.9 by the diameter of the pipe in inches, and divide the product by 2500; the quotient will be the head in feet.

Example. — The length of pipe lying horizontal and straight is 1340 feet, and its diameter is 5 inches; what head is necessary to cause the water to flow through it at the rate of 2 feet per second?

$$2^2 \times 1340 \times \frac{13.9}{5} \div 2500 = 6 \text{ feet.}$$

Doubling the diameter of a pipe increases its capacity four times. Friction of liquids in pipes increases as the square of the velocity.

The mean pressure of the atmosphere is usually estimated at 14.7 lbs. per square inch, so that, with a perfect vacuum, it will sustain a column of mercury 29.9 inches, or a column of water 33.9 feet high.

To find the diameter of a pump cylinder to move a given quantity of water per minute (100 feet of piston being the standard of speed), divide the number of gallons by 4, then extract the square root, and the product will be the diameter, in inches, of the pump cylinder.

To find the velocity of water passing through a straight horizontal pipe of any length and diameter, the head of the fluid above the centre of the orifice being known. (*Winslow.*)

Rule. — Multiply the head, in feet, by 2500, and divide the product by the length of the pipe, in feet, multiplied by 13.9, divided by the interior diameter of the pipe in inches; the square root of the quotient will be the velocity in feet per second.

Example. — The head is 6 feet, length of pipe 1340 feet, and its diameter 5 inches; required the velocity of the water passing through it.

$$2500 \times 6 = 15000 \div \left(\frac{1340 \times 13.9}{5}\right)$$
$$= \sqrt{4.03} = 2 \text{ ft. per second.}$$

Comparison of Thermometers

Fahr.	Cent.	Reau.	Fahr.	Cent.	Reau.
212	100	80	95	35	28
203	95	76	86	30	24
194	90	72	77	25	20
185	85	68	68	20	16
176	80	64	59	15	12
167	75	60	50	10	8
158	70	56	41	5	4
149	65	52	32	0	0
140	60	48	23	— 5	—4
131	55	44	14	—10	—8
122	50	40	5	—15	—12
113	45	36	0	—17.8	—14.2
104	40	32	—4	—20	—16

To change Fahrenheit to Centigrade — subtract 32°, divide remainder by nine and multiply quotient by 5. To change Centigrade to Fahrenheit, divide by 5, multiply quotient by 9 and add 32°. Réaumur is 4-5 of Centigrade.

Table of Diameter of Pipes of sufficient dimensions to discharge a required quantity of water per minute.

Cubic foot by 7.48 = U. S. gallon.

Cubic feet.	Diameter in ins.	Cubic feet.	Diameter in ins.	Cubic feet.	Diameter in ins.
0.5	0.48	18	4.07	130	10.94
1	0.96	20	4.29	140	11.35
2	1.36	25	4.80	150	11.75
3	1.66	30	5.25	160	12.14
4	1.92	35	5.67	170	12.51
5	2.15	40	6.07	180	12.67
6	2.35	45	6.53	190	13.23
7	2.60	50	6.80	200	13.37
8	2.72	55	7.12	225	14.40
9	2.88	60	7.43	250	15.17
10	3.04	70	8.03	275	15.91
11	3.18	80	8.60	300	16.62
12	3.33	90	9.10	350	17.95
13	3.46	100	9.60	400	19.20
14	3.60	110	10.06	500	20.46
15	3.72	120	10.51	600	23.51
16	3.84				

To ascertain the capacity of a cistern or well.

Rule. — Multiply the square of the diameter in inches by the decimal 0.7854, and this product by the depth in inches; divide the product by 231, and the quotient will be the quantity in gallons.

Example. — Cistern 12 feet deep and 6 feet in diameter. The square of 72, the diameter in inches, is 5184:

5184 × 0.7854 = 4071.51;
4071.51 × 144 = 586297.44 cubic inches in cistern;
586297.44 ÷ 231 (cu. ins. in gal.) = 2538 + gallons.

To find the quantity of water elevated in one minute, running at 100 feet of piston speed per minute.

Rule. — Square the diameter of the water cylinder in inches, and multiply by 4.

Example. — Capacity of a 5-inch cylinder required: 5 × 5 = 25 × 4 = 100 gallons per minute (approximately).

Lead Memoranda. (*Kidder.*)

For roofs and gutters, use 7 lb. lead.
For hips and ridges, use 6 lb. lead.
For flashings, use 4 lb. lead.
Gutters should have a fall of at least 1 inch in 10 feet.
No sheet of lead should be laid in greater length than 10 or 12 feet without a drip, to allow for expansion.
Joints in lead pipes require a pound of solder for every inch in diameter.
Lead, 1 inch by 1 foot square, weighs 59½ lbs.
" 1 inch square by 1 foot long, weighs 4.96 lbs.
" 1 inch round by 1 foot long, weighs 3.9 lbs.

To find the lateral pressure of a fluid on the sides of a vessel, tank, or conduit.

Rule. — Multiply the submerged area in inches by the pressure due to one-half the depth.

Example. — To find the lateral pressure on the sides of a tank 12 ft. long by 12 ft. deep: 144 × 144 = 20736 inches of side. The pressure at the bottom will be 12 × 0.43 = 5.16 pounds, while the pressure at top is 0, which gives an average of say 2.6 pounds; therefore, 20736 × 2.6 = 53914 lbs.

Rule for Surface Painting.

Ascertain the superficial feet by multiplying the length by the breadth of the four sides of the house. Add these together and divide the sum by 8, which will give the square yards (allowing for the edges of the clapboards); and divide this quotient by 3, which will give you the number of pounds of paint required.

Example. — Say a house is 40 × 20 × 15:

40 × 15 = 600 (one side)
40 × 15 = 600 "
20 × 15 = 300 (one end)
20 × 15 = 300 "
1800 Sq. ft.

NEW WORK—Outside Priming Coat

100 lbs. Boston Star White Lead
4 gals. Pure Raw Linseed Oil
2 gals. Pure Turpentine
1 pt. Pure Drier

This formula makes about 9 gallons of paint which will cover about 5175 square feet one coat.

Second Coat

100 lbs. Boston Star White Lead
1½ gals. Pure Raw Linseed Oil
1½ gals. Pure Turpentine
1 pt. Pure Drier

This formula makes about 6 gallons of paint which will cover about 3600 square feet one coat.

Third Coat

100 lbs. Boston Star White Lead
3½ to 4½ gals. Pure Raw Linseed Oil
1 pt. Pure Turpentine
1 pt. Pure Drier

This formula makes about 6½ to 7½ gallons of paint which will cover from 3900 to 4500 square feet one coat.

OLD WORK—Outside First Coat

100 lbs. Boston Star White Lead
2 gals. Pure Raw Linseed Oil
2 gals. Pure Turpentine
1 pt. Pure Drier

This formula makes about 7 gallons of paint which will cover about 4200 square feet one coat.

Second Coat

100 lbs. Boston Star White Lead
3½ to 4½ gals. Pure Raw Linseed Oil
1 pt. Pure Turpentine
1 pt. Pure Drier

This formula makes about 6½ to 7½ gallons of paint which will cover from 3900 to 4500 square feet one coat.

A heavy body falling freely acquires a velocity of 32.2 feet per second.

The velocity imparted to water by a given head is the same as that acquired by a heavy body in falling through a height equal to the head; hence, to find the velocity of water —

Rule. — Multiply the height by twice 32.2, and extract the square root of the product, which will give the velocity in feet per second.

Example. — To ascertain the velocity in a fall of 4 feet: 32.2 × 2 = 64.4 × 4 = √257.6 = 16.04 ft. per second. For all ordinary purposes it is sufficiently accurate to say that the velocity is 8 times the square root of the height, and the height is $\frac{1}{64}$ of the square of the velocity.

To find the number of U. S. gallons contained in a foot of pipe of any diameter.

Rule. — Square the diameter of the pipe in inches, and multiply by 0.0408.

To compute the thickness of a lead pipe when the diameter and the pressure in pounds per square inch are given.

Rule. — Multiply the pressure in pounds per square inch by the diameter of the pipe in inches, and divide the product by twice the tensile resistance of the metal in pounds per square inch, and the quotient will be the thickness required, in one-hundredths of an inch.

To find the thickness of lead pipe required when the head of water is given.

Rule. — Multiply the head in feet by size of pipe wanted, expressed decimally, and divide by 750; the quotient will give thickness required, in one-hundredths of an inch.

Example. — Required thickness of half-inch pipe for a head of 25 feet?

25 × 0.50 ÷ 750 = 0.16 inch.

Trautwine gives the average tensile or cohesive strength of lead as —

Lead, Cast,	1700 to 2400 . . . T	2050 lbs. sq. in.
" Wire,	1200 to 1600.	
" Pipe,	1600 to 1700 . . . T	1650 "

Haswell —

Lead, Cast	1800	"
" Milled	3320	"
" Wire	2580	"

Templeton —

Lead, Cast, square	1824	"
" " round	1432	"
Tin, " square	4736	"
" " round	3719	"

TABLE OF QUANTITY OF WATER DELIVERED BY SERVICE PIPES OF VARIOUS SIZES, UNDER VARIOUS PRESSURES.

Proportion of Head of Water (H) to Length of Pipe (L). Results in gallons per minute.

Diameter of Pipe	H = 10 L.	H = 9 L.	H = 8 L.	H = 7 L.	H = 6 L.	H = 5 L.	H = 4 L.	H = 3 L.	H = 2 L.	H = 1¾ L.	H = 1½ L.	H = 1¼ L.	H = L.	H = ¾ L.	H = ½ L.	H = ⅓ L.	H = ¼ L.	H = ⅕ L.	H = ⅙ L.	H = ⅐ L.	H = ⅛ L.	H = ⅒ L.	H = 1/20 L.
Inches.																							
½	19.8	18.7	17.7	16.5	15.3	14.0	12.5	10.8	8.8	8.3	7.7	7.0	6.3	5.4	4.4	3.6	3.1	2.8	2.6	2.4	2.2	2.1	2.0
⅝	34 5	32.7	30.1	28.9	26.5	24.4	21.8	18.9	15.4	14.4	13.4	12.2	10.9	9.5	7.7	6.3	5.5	4.8	4.4	4.1	3.9	3.6	3.5
¾	54.4	51.7	48.7	45.6	42.2	38.5	34.4	29.8	24.3	22.8	21.1	19.3	17.2	14.9	12.2	9.9	8.6	7.7	7.0	6.5	6.1	5.7	5.4
1	111.8	106.0	100.0	93.5	86.6	79.0	70.7	61.2	50.0	46.8	43.2	39.5	35.3	30.6	25.0	20.4	17.7	15.8	14.4	13.4	12.5	11.8	11.2
1¼	195.2	185.2	174.6	163.3	151.2	138.0	123.4	106.9	87.3	81.6	75.6	69.0	61.7	53.5	43.7	35.6	30.9	27.6	25.2	23.3	21.8	20.6	19.5
1½	308.0	292.1	275.4	257.6	238.5	217.7	194.8	168.7	137.7	128.8	119.3	108.9	97.4	84.3	68.7	56.2	48.7	43.9	39.8	36.8	34.4	32.5	30.8
2	632.2	599.7	566.4	538.9	488.1	447.0	399.8	346.3	282.7	264.4	248.8	223.5	199.9	173.1	141.4	115.4	100.0	89.4	81.6	75.6	70.7	66.6	63.2
2½	1104.0	1048.0	987.8	924.0	855.4	780.9	698.5	604.9	493.9	482.0	427.7	390.4	349.2	302.4	246.9	201.6	174.6	156.2	142.6	132.0	123.5	116.4	110.4
3	1745.0	1651.0	1560.0	1460.0	1351.0	1234.0	1103.0	955.5	780.2	728.8	674.8	615.9	555.5	477.1	390.1	317.8	275.8	246.7	225.2	208.5	195.1	183.9	174.5
4	3581.0	3397.0	3203.0	2996.0	2774.0	2532.0	2265.0	1962.0	1602.0	1496.0	1385.0	1264.0	1133.0	979.3	800.8	653.8	566.2	506.5	463.2	428.0	399.9	377.5	358.1
5	6247.0	5928.0	5588.0	5227.0	4839.0	4417.0	3951.0	3406.0	2791.0	2613.0	2420.0	2209.0	1976.0	1711.0	1394.0	1141.0	987.7	883.5	806.5	746.7	698.5	658.5	624.7
6	9855.0	9349.0	8814.0	8245.0	7633.0	6968.0	6233.0	5391.0	4407.0	4122.0	3817.0	3484.0	3116.0	2693.0	2204.0	1799.0	1558.0	1384.0	1272.0	1178.0	1102.0	1039.0	985.5

TABLE GIVING THE WEIGHTS OF LEAD PIPE, 5 OZ. TO 4 LBS. 8 OZ. PER FOOT, IN RODS FROM 1 TO 100 INCLUSIVE.

Rods.	Weight per Foot.																							Rods.
	lbs. oz. 5	lbs. oz. 6	lbs. oz. 8	lbs. oz. 10	lbs. oz. 11	lbs. oz. 12	lbs. oz. 13	lbs. oz. 14	lbs. oz. 1	lbs. oz. 1 4	lbs. oz. 1 8	lbs. oz. 1 12	lbs. oz. 2	lbs. oz. 2 4	lbs. oz. 2 8	lbs. oz. 2 12	lbs. oz. 3	lbs. oz. 3 4	lbs. oz. 3 8	lbs. oz. 4	lbs. oz. 4 8	
1	5 3	6 3	8 4	10 5	11 6	12 6	13 7	14 7	16 8	20 10	24 12	28 14	33 0	37 2	41 4	45 6	49 8	53 10	57 12	66 0	74 4	1
2	10 5	12 6	16 8	20 10	22 11	24 12	26 13	28 14	33 0	41 4	49 8	57 12	66 0	74 4	82 8	90 12	99 0	107 4	115 8	132 0	148 8	2
3	15 8	18 9	24 12	30 15	34 1	37 2	40 4	43 5	49 8	61 14	74 4	86 10	99 0	111 6	123 12	136 2	148 8	160 14	173 4	198 0	222 12	3
4	20 10	24 12	33 0	41 4	45 6	49 8	53 10	57 12	66 0	82 8	99 0	115 8	132 0	148 8	165 0	181 8	198 0	214 8	231 0	264 0	297 0	4
5	25 13	30 15	41 4	51 9	56 12	61 14	67 1	72 3	82 8	103 2	123 12	144 6	165 0	185 10	206 4	226 14	247 8	268 2	288 12	330 0	371 4	5
6	30 15	37 2	49 8	61 14	68 1	74 4	80 8	86 10	99 0	123 12	148 8	173 4	198 0	222 12	247 8	272 4	297 0	321 12	346 8	396 0	445 8	6
7	36 2	43 5	57 12	72 3	79 7	86 10	93 14	101 1	115 8	144 6	173 4	202 2	231 0	259 14	288 12	317 10	346 8	375 6	404 4	462 0	519 12	7
8	41 4	49 8	66 0	82 8	90 12	99 0	107 4	115 8	132 0	165 0	198 0	231 0	264 0	297 0	330 0	363 0	396 0	429 0	462 0	528 0	594 0	8
9	46 7	55 11	74 4	92 13	102 2	111 6	120 11	129 15	148 8	185 10	222 12	259 14	297 0	334 2	371 4	408 6	445 8	482 10	519 12	594 0	668 4	9
10	51 9	60 10	82 8	103 2	113 7	123 12	134 1	144 6	165 0	206 4	247 8	288 12	330 0	371 4	412 8	453 12	495 0	536 4	577 8	660 0	742 8	10
20	103 2	121 4	165 0	206 4	226 14	247 8	268 2	288 12	330 0	412 8	495 0	577 8	660 0	742 8	825 0	907 8	990 0	1072 8	1155 0	1320 0	1485 0	20
30	154 11	181 14	247 8	309 6	340 5	371 4	402 3	433 2	495 0	618 12	742 8	866 4	990 0	1113 12	1237 8	1361 4	1485 0	1608 12	1732 8	1980 0	2227 8	30
40	206 4	242 8	330 0	412 8	453 12	495 0	536 4	577 8	660 0	825 0	990 0	1155 0	1320 0	1485 0	1650 0	1815 0	1980 0	2145 0	2310 0	2640 0	2970 0	40
50	257 13	303 2	412 8	515 10	567 3	618 12	670 5	721 14	825 0	1031 4	1237 8	1443 12	1650 0	1856 4	2062 8	2268 12	2475 0	2681 4	2887 8	3300 0	3712 8	50
60	309 6	363 12	495 0	618 12	680 10	742 8	804 6	866 4	990 0	1237 8	1485 0	1732 8	1980 0	2227 8	2575 0	2722 8	2970 0	3217 8	3465 0	3960 0	4455 0	60
70	360 15	424 6	577 8	721 14	794 1	866 4	938 7	1010 10	1155 0	1443 12	1732 8	2021 4	2310 0	2598 12	2887 8	3176 4	3465 0	3753 12	4042 8	4620 0	5197 8	70
80	412 8	485 0	660 0	825 0	907 8	990 0	1072 8	1155 0	1320 0	1650 0	1980 0	2310 0	2640 0	2970 0	3300 0	3630 0	3960 0	4290 0	4620 0	5280 0	5940 0	80
90	464 1	545 10	742 8	928 2	1020 15	1113 12	1206 9	1299 6	1485 0	1856 4	2227 8	2598 12	2970 0	3341 4	3712 8	4083 12	4455 0	4826 4	5197 8	5940 0	6682 8	90
100	515 10	606 4	825 0	1031 4	1134 6	1237 8	1340 10	1443 12	1650 0	2062 8	2475 0	2887 8	3300 0	3712 8	4125 0	4537 8	4950 0	5362 8	5775 0	6600 0	7425 0	100

Quantity of water that will flow through a pipe 500 feet long in 24 hours, with a fall of 10 feet.

⅜	inch bore	.....	576 gallons
½	"	.....	1,150 "
⅝	"	.....	2,040 "
¾	"	.....	3,200 "
1	"	.....	6,624 "
1¼	"	.....	10,000 "

To Ascertain the Weight of Lead

Rule. — Find the number of cubic inches in the piece; multiply them by 0.41015, and the product will be the weight in pounds.

Example. —What is the weight of a lead pipe 12 feet long, 3¾ inches in diameter, and 1 inch thick.

Area of $(3\frac{3}{4} \div 1 \div 1) = 25.967$

Area of $3\frac{3}{4} = 11.044$

Difference, or area of wall, 14.923×144 (12 feet)

$= 2148.912 \times 0.41015 = 881.376$ lbs.

TABLE SHOWING THE WEIGHT OF PIPE REQUIRED FOR A GIVEN HEAD (OR FALL) OF WATER.

Head, or No. of Ft. Fall.	Pressure per Sq. Inch.	Calibre and Weight per Foot of Lead Pipe Required.													
		⅜ inch.		½ inch.		⅝ inch.		¾ inch.		1 inch.		1¼ inch.		1½ inch.	
		lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Fountain.		0	6	0	8	0	13	0	14	1	8	2	0	3	0
				0	10	1	0	1	0						
30	15 lbs.	0	8	0	12	1	4	1	4	1	12	2	8	3	8
						1	8	1	8	2	0				
40	20 "	0	10	0	14	1	12	1	12	2	8	3	0	4	0
		0	12	1	0			2	0						
50	25 "	0	12	1	4	1	12	2	4	3	0	4	0	4	8
						2	0	2	8					5	0
75	38 "	1	0	1	8	2	4	3	0	4	0	4	8	6	0
				1	12	2	8	3	8			5	0		
100	50 "	1	4	2	0	2	12	4	0	5	0	7	0	10	0
						3	0								
150	75 "	1	4	2	8	3	4	4	8	6	0	9	0	12	0
		1	8			3	8								
200	100 "	1	8	3	0	4	0	5	0	7	0	12	0	15	0

☞ The above weights of pipe are of sufficient strength to permit the water to be shut off (or stopped). When the water is permitted to run continually, lighter weight can be used, — say two-thirds above weights.

Good Advice.

The *Manufacturers' Gazette* relates of a western railway company which gives the following advice to its employés gratis. It is applicable to employés in all parts of the country: "The servant, man or woman, who begins a negotiation for service by inquiring what privileges are attached to the offered situation, and whose energy is put chiefly in stipulations, reservations, and conditions to 'lessen the burden' of the place, will not be found worth the hiring. The clerk whose last place was 'too hard for him' has a poor introduction to a new sphere of duty. There is only one spirit that ever achieves a great success. The man who seeks only how to make himself most useful, whose aim is to render himself indispensable to his employer, whose whole being is animated with the purpose to fill the largest possible place in the walk assigned to him, has, in the exhibition of that spirit, the guarantee of success. He commands the situation, and shall walk in the light of prosperity all his days. On the other hand, the man who accepts the unwholesome advice of the demagogue, and seeks only how little he may do, and how easy he may render his place and not lose his employment altogether, is unfit for service; as soon as there is a supernumerary on the list, he becomes disengaged, as least valuable to his employer. The man who is afraid of doing too much is near of kin to him who seeks to do nothing, and was begot in the same family. They are neither of them in the remotest degree a relation to the man whose willingness to do everything possible to his touch places him at the head of the active list."

Tests for Pure Water.

Simple tests of the purity of drinking water issued by the New Jersey State Board of Health: —

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension.

Odor: Fill the bottle half full, cork it and leave it in a warm place for a few hours. If when uncorked it has a smell, the least repulsive, it should be rejected for domestic use.

Taste: If water at any time, even after heating, has a repulsive or disagreeable taste, it should be rejected.

A simple, semi-chemical test is known as the "Heisch test."

Fill a clean pint bottle three-fourths full of the water; add a half teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in the light, in a moderately warm room, for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Cement for Iron Pipe Joints.

Ten pounds of ground litharge (best quality), four pounds of best Paris whiting, half a pound of yellow ochre, two pounds of dry red lead, half an ounce of hemp cut in half-inch lengths; mix well with boiled linseed oil to the consistency of thick putty; make joints in usual way. The above mixture will set quick when heat is applied. It repairs boilers, resists fire, and will set in water.

WEIGHT OF ONE LINEAL FOOT OF 2½ LB. SHEET LEAD FROM 2" TO 24" WIDE

2" x 1 ft. — 6-⅔ oz.
4" x 1 ft. — 13 oz.
6" x 1 ft. — 1¼ lb.
8" x 1 ft. — 1-⅝ lb.
10" x 1 ft. — 2 lb. 1 oz.
12" x 1 ft. — 2½ lb.
14" x 1 ft. — 3 lb.
16" x 1 ft. — 3 lb. 5 oz.
18" x 1 ft. — 3-¾ lb.
20" x 1 ft. — 4 lb. 3 oz.
22" x 1 ft. — 4 lb. 9 oz.
24" x 1 ft. — 5 lb.

DEFINITIONS OF COMMON TERMS

Alloy

An alloy is a compound of two or more metals.

Conductivity

The power of the material to conduct heat, cold, electricity, etc.

Ductility

The proportionate ease with which the material can be drawn out as into wire.

Elastic Limit

The maximum stress a material can bear without permanent distortion.

Elongation

The increase in length which a metal bar undergoes when subjected to a tensile stress sufficient to cause fracture.

Fusibility

The melting temperature of the material.

Malleability

Ability of the material to be hammered into different shapes.

Metallic Luster

The power of reflecting light rays.

Reduction of Area

The amount of contraction of area which takes place at the point of fracture when a metal bar is broken by a direct pulling force.

Tenacity

The strength or the resistance offered by a body to forces tending to pull its particles asunder.

Tensile Strength

The maximum load material can sustain without breaking.

LEAD PIPE—SIZES and WEIGHTS

Calibre	Letter	Weight per Foot	Calibre	Letter	Weight per Foot
3/8 in	E	8 oz. per ft.	1 in.	D	2 lbs. per ft.
3/8 "	D	10 " " "	1 "	C	2½ " " "
3/8 "	C	12 " " "	1 "	B	3¼ " " "
3/8 "	B	1 lb. " "	1 "	A	4 " " "
3/8 "	A	1¼ " " "	1 "	AA	4¾ " " "
3/8 "	AA	1½ " " "	1 "	AAA	6 " " "
3/8 "	AAA	1¾ " " "	1¼ "	E	2 " " "
½ "	E	8 oz. " "	1¼ "	D	2½ " " "
½ "	D	¾ lb. " "	1¼ "	C	3 " " "
½ "	C	1 " " "	1¼ "	B	3¾ " " "
½ "	B	1¼ " " "	1¼ "	A	4¾ " " "
½ "	SPECIAL	1½ " " "	1¼ "	AA	5¾ " " "
½ "	A	1¾ " " "	1¼ "	AAA	6¾ " " "
½ "	AA	2 " " "	1½ "	E	3 " " "
½ "	SPECIAL	2½ " " "	1½ "	D	3½ " " "
½ "	AAA	3 " " "	1½ "	C	4¼ " " "
5/8 "	E	12 oz. " "	1½ "	B	5 " " "
5/8 "	D	1 lb. " "	1½ "	A	6½ " " "
5/8 "	C	1½ " " "	1½ "	AA	7½ " " "
5/8 "	B	2 " " "	1½ "	SPECIAL	8 " " "
5/8 "	A	2½ " " "	1½ "	AAA	8½ " " "
5/8 "	AA	2¾ " " "	1¾ "	D	4 " " "
5/8 "	AAA	3½ " " "	1¾ "	C	5 " " "
¾ "	E	1 " " "	1¾ "	B	6 " " "
¾ "	D	1¼ " " "	1¾ "	SPECIAL	6½ " " "
¾ "	C	1¾ " " "	1¾ "	A	7 " " "
¾ "	SPECIAL	2 " " "	1¾ "	AA	8½ " " "
¾ "	B	2¼ " " "	1¾ "	AAA	10 " " "
¾ "	A	3 " " "	2 "	D	4¾ " " "
¾ "	AA	3½ " " "	2 "	C	6 " " "
¾ "	AAA	4¾ " " "	2 "	B	7 " " "
1 "	E	1½ " " "	2 "	A	8 " " "
			2 "	AA	9 " " "
			2 "	AAA	11¾ " " "

WEIGHT OF CALKING LEAD FOR IRON PIPE JOINTS

Cast-Iron Water Pipe	Pounds Lead, per Joint, 2½ Inches Deep	Pounds Hemp per Joint
3 in.	7.00	.18
4 "	8.75	.21
6 "	12.25	.31
8 "	15.75	.44
10 "	19.00	.53
12 "	22.50	.61
14 "	26.00	.81
16 "	35.75	.94
18 "	40.00	1.00
20 "	44.00	1.25
24 "	52.50	1.50
30 "	64.75	2.06
36 "	77.25	3.00

DECIMAL EQUIVALENTS

1/64 .0156	17/64 .2656	33/64 .5156	49/64 .7656
1/32 .0312	9/32 .2812	17/32 .5312	25/32 .7812
3/64 .0468	19/64 .2968	35/64 .5468	51/64 .7968
1/16 .0625	5/16 .3125	9/16 .5625	13/16 .8125
5/64 .0781	21/64 .3281	37/64 .5781	53/64 .8281
3/32 .0937	11/32 .3437	19/32 .5937	27/32 .8437
7/64 .1093	23/64 .3593	39/64 .6093	55/64 .8593
1/8 .125	3/8 .375	5/8 .625	7/8 .875
9/64 .1406	25/64 .3906	41/64 .6406	57/64 .8906
5/32 .1562	13/32 .4062	21/32 .6562	29/32 .9062
11/64 .1718	27/64 .4218	43/64 .6718	59/64 .9218
3/16 .1875	7/16 .4375	11/16 .6875	15/16 .9375
13/64 .2031	29/64 .4531	45/64 .7031	61/64 .9531
7/32 .2187	15/32 .4687	23/32 .7187	31/32 .9687
15/64 .2343	31/64 .4843	47/64 .7343	63/64 .9843
1/4 .25	1/2 .5	3/4 .75	1 1.0

JUTE AND OAKUM

We carry Jute, dry and tarred, for use with lead in calking water pipe joints. Packed in 50-lb. bales.

Also Plumber's Oakum.

CALKING TOOLS

For use in connection with Calking Lead or Lead Wool.

METRIC CONVERSION TABLE

Arranged by C. W. HUNT, New York

Millimetres × .03937 = inches
Millimetres ÷ 25.4 = inches
Centimetres × .3937 = inches
Centimetres ÷ 2.54 = inches
Metres × 3937 = inches (Act Congress)
Metres × 3.281 = feet
Metres × 1.094 = yards
Kilometres × .621 = miles
Kilometres ÷ 1.6093 = miles
Kilometres × 3280.8693 = feet
Square Millimetres × .00155 = sq. in.
Square Millimetres ÷ 645.1 = sq. in.
Square Centimetres × .155 = sq. in.
Square Centimetres ÷ 6.451 = sq. in.
Square Metres × 10.764 = sq. ft.
Square Kilometres × 247.1 = acres
Hectare × 2.471 = acres
Cubic Centimetres ÷ 16.383 = cu. in.
Cu. Centimetres ÷ 3.69 = fl. dr. (U.S.P.)
Cu. Centimetres ÷ 29.57 = fl. oz. "
Cubic Metres × 35.315 = cubic feet.
Cubic Metres × 1.308 = cubic yards.
Cu. Metres × 264.2 = gals.(231. cu. in.)
Litres×61.022=cu. in. (Act Congress.)
Litres × 33.84 = fl. oz. (U. S. PHAR.)
Litres × .2642 = gallons (231. cu. in.)
Litres ÷ 3.78 = gallons (231. cu. in.)
Litres ÷ 28.316 = cubic feet.
Hectolitres × 3.531 = cubic feet.
Hectolitres × 2.84 = bu.(2150.42 cu. in.)
Hectolitres × .131 = cubic yards.
Hectolitres ÷ 26.42 = gals.(231. cu. in.)
Grams × 15.432 = gr. (Act Congress.)
Grams ÷ 981. = dynes.
Grams (water) ÷ 29.57 = fluid ounces.
Grams ÷ 28.35 = ounces avoirdupois.
Gr. per cu. cm. ÷ 27.7 = lbs. per cu. in.
Joule × .7373 = foot pounds.
Kilo-grams × 2.2046 = pounds.
Kilo-grams × 35.3 = oz avoirdupois
Kilo-grams ÷ 907.2 = tons (2,000 lbs)
Kilo-gr.per sq.cm.× 14.223 = lbs.sq.in.
Kilo gram-metre × 7.233 = foot lbs
Kilo-gr. per Metre × .672 = lbs. per ft.
Kilo-gr.per cu.Metre × .062 = lbs.cu.ft.
Tonneau × 1.1023 = tons (2,000 lbs.)
Kilo-Watts × 1.34 = Horse Power.
Watts ÷ 746. = Horse Power.
Watts × .7373 = ft. pounds per second.
Calorie × 3.968 = B. T. U.
Cheval vapeur ÷ .9863 = Horse Power.
(Centigrade × 1.8) + 32 = degree F.
Franc × .193 = Dollars.
Gravity Parts = 980.94 cm. per sec.

TABLE OF AREAS.

Diameter.	Area.	Diameter.	Area.	Diameter.	Area.	Diameter.	Area.	Diameter.	Area.
Inches.		Inches.		Inches.		Inches.		Inches.	
2	3.1416	4½	15.904	7	38.484	9½	70.882	12	113.098
2¼	3.9760	4¾	17.720	7¼	41.282	9¾	74.662	12¼	117.859
2½	4.9087	5	19.635	7½	44.178	10	78.540	12½	122.718
2¾	5.9395	5¼	21.647	7¾	47.173	10¼	82.516	12¾	127.676
3	7.0686	5½	23.758	8	50.265	10½	86.590	13	132.733
3¼	8.2957	5¾	25.967	8¼	53.456	10¾	90.762	13¼	137.886
3½	9.6211	6	28.274	8½	56.745	11	95.033	13½	143.139
3¾	11.0440	6¼	30.679	8¾	60.132	11¼	99.400	13¾	148.489
4	12.5660	6½	33.183	9	63.617	11½	103.869		
4¼	14.1860	6¾	35.784	9¼	67.200	11¾	108.434		

Demonstration of Table of Areas. — One of our Pumps with 4-inch diameter of cylinder and 8-inch stroke, lifting water 20 feet perpendicular through a 2-inch suction pipe, and forcing it into a tank 50 feet above pump, running at a speed of 40 strokes per minute, how much water will be discharged? Refer to Table of Areas above, and you will find opposite 4 inches 12.566; multiply this by 8, the length of stroke, and have 100.528 cubic inches; multiply this result by 40, the number of strokes per minute, and you have the quantity of water raised with 40 strokes per minute = 4021.120 cubic inches; divide this by 231, the number of cubic inches in a gallon, and you have 17.48 gallons per minute. For a Double-Acting Pump the result would double the above calculation.

Lead, rolled 1 inch thick by 1 foot sq., weighs an average of 60 lbs.

Tin, rolled 1 inch thick by 1 foot square, weighs an average of 40 lbs. The thickness of sheets of either the above metals, of different weights per square foot, can be readily calculated from above.

Rules for weights of castings. — Multiply the weight of the pattern by 12 for cast iron, 13 for brass, 19 for lead, 12.2 for tin, 11.4 for zinc, and the product is the weight of the casting.

MELTING POINT OF METALS.

Metal.	Fahr.	Fahr.	Authority.
Lead	**622**	**620**	J. Lowthian Bell.
Platina	4593	—	"
Antimony	955	842	"
Bismuth	487	507	"
Tin (average)	475	—	"
Zinc	772	782	"
Cast Iron	2010	1922–2012, White 2012–2192, Gray	Pouillet.
Wrought Iron	2910	2733, welding heat	"
Steel	2370	2550	
Copper (average)	2174	—	

To find the area of a circle in square inches, multiply the diameter in inches by itself, and by 0.7854.

To find the circumference of a circle in inches, multiply the diameter in inches by 3.1416.

A gallon of water contains 231 cubic inches, or $\frac{231}{0.7854} = 294$ cylindrical inches.

A cubic foot contains 7.48 gallons.

COMPARISON OF GAUGES

No.	Stubs	B & S	U. S.	No.	Stubs	B & S	U. S.	No.	Stubs	B & S	U. S.
7–0	....	....	.5	10	.134	.10189	.140625	26	.018	.01594	.01875
6–0	....	...	.46875	11	.120	.09074	.125	27	.016	.014195	.0171875
5–0	....	....	.4375	12	.109	.08081	.109375	28	.014	.012641	.015625
4–0	.454	.460	.40625	13	.095	.07196	.09375	29	.013	.011257	.0140625
3–0	.425	.40964	.375	14	.083	.06408	.078125	30	.012	.010025	.0125
2–0	.380	.3648	.34375	15	.072	.05707	.0703125	31	.010	.008928	.0109375
0	.340	.32495	.3125	16	.065	.05082	.0625	32	.009	.00795	.01015625
1	.300	.28930	.28125	17	.058	.04525	.05625	33	.008	.00708	.009375
2	.284	.25763	.265625	18	.049	.04030	.05	34	.007	.00603	.00859375
3	.259	.22942	.25	19	.042	.03589	.04375	35	.005	.00561	.0078125
4	.238	.20431	.234375	20	.035	.03196	.0375	36	.004	.005	.00703125
5	.220	.18194	.21875	21	.0315	.02846	.034375	37	....	.00445	.006640625
6	.203	.16202	.203125	22	.028	.025347	.03125	38	....	.003965	.00625
7	.180	.14428	.1875	23	.025	.022571	.028125	39	....	.003531	.....
8	.165	.12849	.171875	24	.022	.0201	.025	40	....	.003144	.....
9	.148	.11443	.15625	25	.020	.0179	.021875				

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